BEAUTS

BEAUFORT AREA TRANSPORTATION STUDY

TECHNICAL MEMORANDA VOLUME III

APRIL 1972

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BEAUFORT AREA TRANSPORTATION STUDY

Prepared by

SOUTH CAROLINA STATE HIGHWAY DEPARTMENT

In Cooperation With

CITIES OF BEAUFORT & PORT ROYAL AND BEAUFORT COUNTY

U. S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

TECHNICAL MEMORANDA — VOLUME III

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CHAPTER I

GENERAL INFORMATION

The Beaufort Area Transportation Study, known by the acronym "BEAUTS", is a joint effort by the U.S. Department of Transportation - Federal Highway Administration, Beaufort County and the South Carolina State Highway Department, to develop a comprehensive street and highway plan that will be adequate to serve traffic needs in the Beaufort area through 1990.

Basic Agreements

Recognizing the need for long-range planning of the community's streets and highways, Beaufort County entered into an agreement with the State Highway Department on May 15, 1969. A copy of the agreement which outlines the services to be performed by the Highway Department and the County is contained in the Appendix (A-1). Resolutions were received from the cities of Beaufort and Port Royal, as shown in the Appendix (A-2), authorizing Beaufort County to act in their behalf in all matters pertaining to the comprehensive transportation planning process.

Purpose of This Memoranda

This memoranda describes the technical procedures and methods used in BEAUTS relative to data collection, accuracy checks, mathematical models and the external trip projections.

Field Office

A temporary field office (approximately 600 square feet) was set up in the Beaufort Arsenal on Craven Street during the data collection and coding phases (June 10, 1969 - September 26, 1969). Ralph G. Bowers was project director and Donald L. Gorsline, John P. Devaney and William A. Brooks

from the Advance Planning Section assisted in the collection and supervision of the data. The temporary help consisted of a secretary, clerks and home-telephone & roadside interviewers.

Study Area

The study area for BEAUTS contains the area expected to become urbanized or developed by the design or forecast year - 1990. As shown in Figure 1, this area encompasses 90 square miles and includes the municipalities of Beaufort and Port Royal. Also included in the study area are the military installations of Parris Island Marine Base & the Marine Corps Air Station and Laurel Bay (military housing). BEAUTS is generally bound on the west by the Broad River, on the north by Whale Branch and the east by Lucy Point & Chowan Creeks.

Traffic Zones and Codes

To facilitate the analysis of data collected in the origin-destination surveys, the BEAUTS area and the remaining portion of Beaufort County were divided into geographical areas called traffic zones (see Figures 1 & 2 in BEAUTS Volume II report).

BEAUTS Zones: The study area was divided into four (4) sectors and these sectors were subdivided into 68 traffic analysis zones for detailed data collection and analyses. The sequence and total number of traffic zones within each sector are as follows:

Sector	Zone Number	No. of Zones
1	01 - 20	20
2	21 - 36	16
3	37 - 59	23
4	60 - 68	9
		68

A complete description of the six-digit coding scheme that was used


N
LEGEND
AREA BOUNDARY
SCREENLINES
STUDY AREA
SCALE OF MILES
SCREENLINE #1
SCREENLINE #2
SLI
SLII
SLIII
SLIV
SLV
SLVI
SLVII
SLVIII
PORT ROYAL ISLAND
BEAUFORT
BROAD RIVER
BATTERY CREEK
MARINE CORPS AIR AUX. STATION
PARRIS ISLAND MARINE BASE
PORT ROYAL POP. 685
SEABROOK
COOSAW
LAUREL BAY
CAPEHART HOUSING PROJECT
FROGMORE
WARSAW ISLAND
DATHA ISLAND
JUDGE ISLAND
GUN BOAT ISLAND
CHISOLM I.
HALFMOON ISLAND
JACK ISLAND
PORKY ISL.
BALL ISLAND
LITTLE BARNWELL ISLAND
BARNWELL ISLAND
HALL ISLAND
COTTON ISL
WHALE BRANCH
COOSAW RIVER
WATERWAY

-3-

FIGURE 1

to reference the various data to the internal traffic zones is as follows:

Digit	Description	Possible Codes
1	Signifies the sector within the study area	1 - 4
2,3	No significance	00
4,5	Identifies the zone number	01 - 68
6	Identifies the major generator	1 - 9

Beaufort County Zones: Beaufort County, excluding the BEAUTS area, was divided into 14 traffic analysis zones. A general description of the six digits of these codes are as follows:

Digit	Description	Possible Codes
1,2,3	Signifies Beaufort County	713
4	No significance	0
5,6	Identifies the zone	01 - 14

Other South Carolina Counties: Areas beyond Beaufort County were identified by city and county using the IBM Reference Manual. A general description is as follows:

Digit	Description	Possible Codes
1	Signifies South Carolina	8
2,3	Identifies the County	01 - 91
4,5,6	Identifies the City	010 - 999

Other States: Other states, excluding South Carolina, are identified by state and county using the IBM Reference Manual. A general description is as follows:

Digit	Description	Possible Codes
1	Signifies states other than South Carolina	9
3,4	Identifies the State	01 - 54
5,6,7	Identifies the County	001 - 999

CHAPTER II

HOME-TELEPHONE INTERVIEW SURVEY

The primary purpose of the home-telephone interview survey was to collect vehicle-driver trips made by internal residents of the BEAUTS area. Certain dwelling unit information was also obtained at each sample address so that trip production could be correlated with these and other planning data.

The following sections discuss the design and administration of the various phases of the home-telephone survey. The techniques used were similar to those prescribed by the U.S. Department of Transportation in the Manual of Procedures for Home Interview Traffic Study.

Sample Selections

The selection of the dwelling unit samples was made in the field at the time of inventory. A 12½ percent dwelling unit sample (1 in 8) was used in the densely populated areas, while in the sparsely developed rural areas a 25 percent sample (1 in 4) was used. A minimum of 10 samples, however, was set as the control for each traffic zone to provide statistical stability. Table 1 shows the sample rate used for each zone and the zones that required a minimum of 10 samples.

The field canvassing in sectors 1, 2 and 4 began with the lowest zone number and continued consecutively throughout the various zones that compiled these sectors. In sector 3 this rule was waived because of the lack of time, and each zone was sampled individually without regard to zone number. Each dwelling unit was given a count number and when a 12½ percent sample was taken, those dwelling units with a count of 8, or any multiple of 8, were the samples. If a 25 percent sample was taken, those dwelling units

TABLE 1

SAMPLE RATE

Zone	Percent Sample Rate	Zone	Percent Sample Rate	Zone	Percent Sample Rate
01	(1)	24	12½	47	12½
02	12½	25	(1)	48	25
03	12½	26	(1)	49	25
04	12½	27	12½	50	25
05	12½	28	12½	51	25
06	12½	29	12½	52	12½
07	12½	30	12½	53	(3)
08	12½	31	12½	54	25
09	12½	32	(1)	55	(4)
10	(1)	33	12½	56	25
11	12½	34	12½	57	25
12	12½	35	12½	58	25
13	12½	36	12½	59	25
14	(1)	37	(2)	60	25
15	12½	38	25	61	25
16	12½	39	25	62	(1)
17	12½	40	12½	63	(1)
18	(1)	41	12½	64	25
19	12½	42	12½	65	25
20	(1)	43	(1)	66	25
21	(1)	44	12½	67	(1)
22	(1)	45	25	68	25
23	12½	46	12½		

(1) Minimum of 10 samples per zone varied sample rate.

(2) 12½ percent sample rate for military housing on Parris Island. Sample rate varied for permanent personnel (excluding trainees) living in barracks on Parris Island.

(3) 12½ percent sample rate for military housing on Marine Corps Air Station. Sampled military personnel living in barracks on Marine Corps Air Station and owning an automobile.

(4) 10 percent sample rate was used to collect the dwelling unit information on Laurel Bay. A roadside interview station was operated at the gate to collect the trip data.

with a count of 4, or any multiple of 4, became the samples. The sample address was recorded with the name of the resident, telephone number when available and a description of the dwelling unit.

Interviews were made at motels that housed long-term guests. The sample rate varied depending upon the number at each motel.

Interview Forms

The two interview forms that were used in the home-telephone interview survey are contained in the Appendix (A-3). Census type information such as population, number of vehicles owned, number of licensed drivers, people employed and places of employment, number attending school and name of the school were recorded on the Dwelling Unit Summary Report. The Internal Trip Report was used to list the address and purpose at both the origin and destination of all vehicle-driver trips (automobiles, pickups and heavy trucks).

Personnel Training and Control Procedures

Contacts were made with the local employment agency and advertisements were placed in the local newspaper for female interviewers who were at least high school graduates, had access to an automobile and could work a minimum of 20 hours per week. Before any ladies were hired, all applicants were interviewed by the permanent staff and given a simple aptitude test. Five of the persons interviewed were hired at the rate of $1.60 per hour and were put through classroom instructions on the home interview manual (copy of this manual is in the project work files). After these classes were completed, the interviewers received on-the-job training until the supervisors felt they were capable of collecting the information by telephone as well as by personal contact. Interviewers were reimbursed for

car expenses at the rate of nine cents per mile.

The field supervisors maintained close liaison with the interviewers to edit and coordinate their work. They were responsible for seeing that representative weekday travel was being obtained. Each supervisor accompanied the interviewers once every week and made telephone callbacks to insure accuracy.

Interview Summary

The home-telephone interview field work was conducted between June 24 and September 26, 1969. The interview sample consisted of 1385 regular dwelling units and 303 special units (shown in Table 2).

The low rate of refusals (13) points out the splendid cooperation of Beaufort area residents. In most cases the pre-interview letter, which is contained in the Appendix (A-4), was mailed out several days ahead of the interviewer's contact and helped considerably in obtaining the necessary information. In rural areas the letter was delivered personally since the interview was usually conducted at the time the sample was selected.

Coding and Keypunching

Coding of the home-telephone interviews, as well as the roadside interviews, was done in the BEAUTS field office. The interviewers and office clerks coded the data to predetermined numbers so that the information could be punched on IBM cards. Certain controls and edit checks were made on the coded and keypunched data to insure good results. All errors were corrected prior to computing the expansion factor.

Factoring

The dwelling unit information and trip data collected in each traffic zone on a sample basis were expanded to represent the total characteristics for that area. The following equation was used to determine these factors.

TABLE 2

HOME-TELEPHONE INTERVIEW SAMPLE RESULTS

Regular samples selected	1385
Special samples selected at Laurel Bay (Dwelling unit information only)	109
Special samples selected on Parris Island in the barracks	60
Special samples selected on MCAS in the barracks	95
Special samples selected at the Naval Hospital	9
Motel and other samples	30
	1688

Completed interviews	1543
Incomplete:	
Vacancies	107
Refusals	13
Other reasons	25
	1688

Special units i.e. motels, nursing homes were given an expansion factor based on the sample rate for each special unit.

$$\text{Dwelling Unit Factor} = \frac{A - (C \times \frac{A}{B})}{B - (C + D)}$$

Where:

A = Total number of dwelling units in the zone.

B = Total number of samples selected in the zone including all those not complete for reason of vacancy, refusal and other.

C = Sum of sample dwellings found to be vacant, demolished, or used for commercial purpose only.

D = Sum of interviews "missed" because of contagious sickness in household, no one found at home, or residents refused to answer questions.

Computations were carried to the nearest two decimal places and the results were used to expand all data collected in each zone. The work sheets used in computing the individual factors are contained in the project work files.

CHAPTER III

EXTERNAL ROADSIDE INTERVIEW SURVEY

This survey was undertaken during July, 1969, and its purpose was to determine the travel characteristics of the vehicle-drivers that entered and left the BEAUTS area during a typical summer weekday. This data was used together with the home-telephone interview survey to establish a daily travel pattern for the study area.

Interview Locations

Prior to beginning any field work, manual and machine counts were made on the three highways that crossed the study area boundary to determine the daily volume of traffic using each facility. The location of the interview stations, hours of operation and the dates that the interviews were taken are given in Table 3.

Interview Form

A copy of the interview form on which the field data was recorded is contained in the Appendix (A-5). The information obtained from each driver included the origin, destination, purpose of the trip and his home address. The vehicle type and the number of people in each vehicle were recorded by observation. Drivers proceeding out of the study area were also questioned about the number of stops made in the BEAUTS area.

Training and Field Procedures

Seven college students and high school graduates from the area were hired and trained to do the roadside interviews. The external cordon survey manual (contained in the project work files) was used as the text in the classroom instruction.

TABLE 3

STATION LOCATIONS AND SCHEDULE

EXTERNAL ROADSIDE SURVEY

Station Number	Route	Date of Interview	Day of Week	Interview Time	Location of Interview Station
69	US 21 South	July 8	Tuesday	6am-1pm	Just S. of Rd. 456
69	US 21 South	July 15	Tuesday	1pm-8pm	Just S. of Rd. 456
70	US 21 North	July 9	Wednesday	6am-1pm	Just N. of Whale Branch
70	US 21 North	July 16	Wednesday	1pm-8pm	Just N. of Whale Branch
71	SC 170	July 10	Thursday	6am-1pm	Just S. of Broad River Bridge
71	SC 170	July 17	Thursday	1pm-8pm	Just S. of Broad River Bridge

Interviewers worked under the supervision of John P. Devaney. Interviews were conducted for a 14-hour period at each of the three roadside locations. They worked from 6 a.m. to 1 p.m. at each location and returned the next week to interview the afternoon hours (1 p.m. - 8 p.m.). Before beginning the field work at a particular roadside interview station, the hourly traffic count data was studied by the supervisor to determine man power needs and the sampling rate. In most cases a 100 percent sample was taken.

On the first day of the roadside survey, the temporary employees were given on-the-job training in how to interview and how to record the information properly on the form. This training was provided by Highway Department personnel. The supervisor was responsible for checking each interviewer's work throughout the survey to insure that complete origin-destination addresses were being obtained and that proper interviewing techniques were being used. A highway patrolman was present at each of the interview station locations to handle the movement of traffic.

Interview Summary

As shown in Table 4, of the total 10,200 vehicles which entered and left the study area during a typical 1969 summer weekday, 80 percent of the traffic movement occurred between 6 a.m. - 8 p.m. (the hours during which interviews were conducted). A total of 6,509 interviews were obtained at the three interview locations which accounted for 80 percent of the 8,119 vehicles that passed the stations during the interview hours. Good cooperation was received from the motoring public.

Factoring

The factoring process was done by computer after the interviews had been edited for coding and keypunching errors. The interviews at each station were

TABLE 4

TRAFFIC VOLUMES AND INTERVIEW SUMMARIES

EXTERNAL ROADSIDE SURVEY

Station Number	Route	Traffic Volume Passing Interview Station 24-Hr.	6am-8pm	Interviews No.	% of 14-hr. Volume
69	US 21 South	3700	2954	2214	74.9
70	US 21 North	3600	2846	2106	74.0
71	SC 170	2900	2319	2189	94.4
Total		10200	8119	6509	80.2

factored by hour, direction and vehicle type (passenger cars, light trucks and heavy trucks) to correspond with the actual ground count of vehicles passing during the interview hours. A day factor was also applied to the interview data to reflect the 24-hour station volume. The 24-hour control totals for each station were derived by direction for each type of vehicle by using the following procedure:

(1) Manual classification counts (2, 3, 4, 5 axles, etc.) were made during the 14-hour interview day. Also 24-hour classification counts were made at all interview stations on a non-interview day.

(2) The average weekday traffic volumes (two-axle volumes) were determined from the recording meter counts made during the 2-week span in which the interviews were undertaken.

(3) An axle adjustment factor determined from data collected in (1) was applied to (2) to arrive at the two-way station control volumes.

(4) The station control total was split equally by direction and control totals were established for passenger cars, light trucks and heavy trucks based upon the 24-hour percentage of each classification determined from (1).

The hour and day factors for each external station are contained in the project work files.

CHAPTER IV

SPECIAL INTERVIEW SURVEYS

Special interview surveys were conducted to complement the home-telephone and external roadside data collection in BEAUTS. The procedures used in collecting screenline interviews and interviews at Laurel Bay and the military installations will be discussed in this section.

Screenline Interview Survey

Screenline interviews were collected at three locations (see Figure 1) and were used as a check to determine the completeness of the trip data collected in the home-telephone and external roadside surveys.

Prior to beginning any field work, manual and machine counts were made on the three highways crossing the screenlines to determine the daily volume of traffic using each highway. The location of these interview stations, hours of operation and the date the interviews were conducted are shown in Table 5.

The interview stations were operated for a 14-hour period from 6 a.m. to 8 p.m. and data was recorded on the external roadside interview form. These interviews were then factored to reflect the 24-hour volume by direction for each type of vehicle. The control total for each station was derived by using the same procedure as discussed in the external roadside interview survey. The station volumes, number of vehicles passing from 6 a.m. - 8 p.m. and number & percent interviewed are depicted in Table 6.

Roadside Interviews at Laurel Bay Gate

Laurel Bay is "off base" military housing with only one gate for entry and exit for the personnel of Marine Corps Air Station and Parris Island.

On August 4 & 5 roadside interviews were conducted just outside the gate to collect the trips made by people living on Laurel Bay. This

TABLE 5

STATION LOCATIONS AND SCHEDULE

SCREENLINE INTERVIEW SURVEY

tation Number	Route	Date of Interview	Day of Week	Interview Time	Location of Interview Station
72	SC 281	July 28	Monday	6am-1pm	Just S. of Battery Creek Bridge
72	SC 281	July 14	Monday	1pm-8pm	Just S. of Battery Creek Bridge
73	US 21	July 22	Tuesday	6am-1pm	Just S. of Beaufort River Bridge
73	US 21	July 29	Tuesday	1pm-8pm	Just S. of Beaufort River Bridge
74	US 21	July 23	Wednesday	6am-1pm	Northbound direction between Hogarth & Greenlawn Streets
74	US 21	July 30	Wednesday	1pm-8pm	Northbound direction between Hogarth & Greenlawn Streets
74	US 21	July 24	Thursday	6am-1pm	Southbound direction between Hogarth & Greenlawn Streets
74	US 21	July 31	Thursday	1pm-8pm	Southbound direction between Hogarth & Greenlawn Streets

TABLE 6

TRAFFIC VOLUMES AND INTERVIEW SUMMARIES

SCREENLINE INTERVIEW SURVEY

Station Number	Route	Traffic Volume Passing Interview Station		Interviews	
		24-Hr.	6am-8pm	No.	% of 14-Hr. Volume
72	SC 281	7200	6141	2829	46.1
73	US 21	6500	5857	3128	53.4
74	US 21	19800	16251	5189	31.9
Total		33500	28249	11146	39.5

interview station was operated from 6 a.m. to 1 p.m. on one day and from 1 p.m. to 8 p.m. on the next day (only the inbound vehicles were interviewed). For all drivers living at Laurel Bay, the origin, destination, time and purpose of all trips made since leaving home were recorded on a special interview form, contained in the Appendix (A-6). If the motorist did not reside at Laurel Bay, a normal roadside interview of that trip was conducted. In addition to the roadside interviews at the gate, 10 percent of the 1100 dwelling units were contacted to collect certain census type information.

The interviews were factored using the same procedure used in the external roadside interview survey. The work sheets used in computing these factors are contained in the project work files.

Home-Telephone Interviews at the Military Installations

Home-telephone interviews were obtained at 12½ percent (1 in 8) of all the dwelling units (base housing) on the Marine Corps Air Station and Parris Island. A special pre-interview letter, contained in the Appendix (A-7), was used for each installation and was a big help to the interviewers in obtaining the necessary cooperation. Interviews were also collected from a sample of the permanent personnel (trainees excluded) living in the barracks and owning an automobile.

The interviews obtained at the military installations were factored to represent the universe. The work sheets used in computing these factors are contained in the project work files.

CHAPTER V

ACCURACY CHECKS

In order to forecast and distribute future trips it was necessary to have an accurate measure of existing travel and planning characteristics. The completeness and accuracy of the survey results obtained in BEAUTS were evaluated through the following checks:

1. Comparison of census type data collected in the home-telephone interview survey with similar type data provided by the State Planning and Grants Division and the Beaufort County Joint Planning Commission.
2. Comparison of survey trips crossing the two screenlines with observed traffic volumes.
3. Comparison of traffic assignment and vehicle miles of travel with observed traffic volumes and calculated vehicle miles of travel.
4. Comparison of trips made by internal residents crossing the external cordon as measured in both the roadside and home-telephone interview surveys.

Results of these various accuracy checks made on the base year data will be discussed in this chapter along with the techniques that were used to expand the survey data to more nearly simulate observed conditions.

Planning Data Checks

The expanded census-type information collected in the BEAUTS interview surveys compared favorably with similar type data provided by the State Planning and Grants Division and the Beaufort County Joint Planning Commission. Dwelling units and population from these independent sources, when compared with BEAUTS data, differed by only four and seven percent respectively. Total employment data at selected generators compared within 14 percent and

school enrollment within 18 percent. Since explanations could be offered for most of the discrepancies, even on the sub area basis, it was concluded that the transportation study household data was indicative of that existing in the study area. These planning data can therefore be used along with the trip characteristics to develop the necessary relationship needed in the transportation planning process. The details of the planning data comparisons are discussed in the following sections.

Dwelling Units - Data collected by the State Planning and Grants Division in their Neighborhood Analysis Report are shown in Table 7 along with similar information collected in the home-telephone interview survey. Differences between the two sets of data for zones 1, 3 & 6, 4 and 5 were attributed to any or all of the following reasons:

- The difference in distinguishing between single and multi-family units
- Addition or deletion of structures between time of the two independent surveys
- Variation between the boundary of the analysis areas used in the two surveys

Population - The BEAUTS population, also shown in Table 7, was obtained by expanding the number of persons residing at each sample address by the dwelling unit factor for each zone. The State Planning and Grants Division figures were obtained by multiplying occupied dwelling units times a 3.68 factor for zones 14, 43, 44 and 45 and a 3.41 factor for the remaining zones. The largest discrepancy occurred in zone 10, where the BEAUTS data indicated older or retired families and therefore, persons per dwelling unit were lower than the average used by the State Planning and Grants Division.

Employment and School Enrollment - Employment at select generators and school enrollment data collected in the BEAUTS interview surveys are shown in Tables 8 and 9 along with similar information as reported by the Beaufort County Joint Planning Commission. Although these checks were not as good

TABLE 7

DWELLING UNIT - POPULATION

ACCURACY CHECK

Zone[1]	Dwelling Units			Population		
	State Planning & Grants Division	BEAUTS	BEAUTS/SP&GD Ratio	State Planning & Grants Division	BEAUTS	BEAUTS/SP&GD Ratio
1	29	47	162.1	80	65	81.3
2 & 7	254	258	101.6	825	759	92.0
3 & 6	228	198	86.8	735	515	70.1
4	98	115	117.3	322	241	74.8
5	78	100	128.2	258	275	106.6
8 & 9	191	206	107.9	600	540	90.0
10	50	53	106.0	165	106	64.2
11	99	97	98.0	334	349	104.5
12	318	323	101.6	1070	1067	99.7
13	194	209	107.7	650	531	81.7
14,43,44 & 45	337	349	103.6	1200	1302	108.5
15	126	129	102.4	416	372	89.4
16	154	149	96.8	515	380	73.8
17	92	100	108.7	310	285	91.9
18	50	53	106.0	165	159	96.4
19	87	92	105.7	295	222	75.3
20,22,25 & 26	94	103	109.6	310	257	82.9
21	74	74	100.0	240	170	70.8
23	287	299	104.2	950	866	91.2
24	232	247	106.5	766	956	124.8
27	199	201	101.0	655	667	101.8
Total	3271	3402[2]	104.0	10861	10084[2]	92.8

(1) See Figure 1 - Volume II Report for zone map.

(2) Does not include entire BEAUTS area.

TABLE 8

EMPLOYMENT

ACCURACY CHECK

Major Employers	Zone Location	Beaufort Co. Plan. Comm.	BEAUTS	BEAUTS/BCPC Ratio
Beaufort Elementary	5	20	16	80.0
University of S.C. Beaufort Branch	5	20	14	70.0
Beaufort Jr. High	11	43	31	72.1
S.C. State Highway Department	14	61	45	73.8
Robert Smalls School	15	87	47	54.0
Battery Creek Elementary	16	23	24	104.3
Beaufort Memorial Hospital	20	138	106	76.8
Beaufort High School	24	67	51	76.1
Mossy Oaks Elementary	27	32	15	46.9
Royal Oaks Shopping Center	31	85	78	91.8
Naval Hospital	32	580	404	69.7
Port Royal Elementary	34	9	4	44.4
Blue Channel Corp.	35	300	130	43.3
Parris Island	37	3937	3093	78.6
Shell Point Elementary	38	25	41	164.0
Broad River Elementary	48	26	20	76.9
Marine Corps Air Station	53	6144	5817	94.7
Blake & Johnson Co.	54	93	88	94.6
Marine Corps Air Station Elem 1 & 2	55	82	36	43.9
Garland Knitting Mills	56	120	114	95.0
Beaufort Academy	64	22	17	77.3
Lady's Island School	67	22	38	172.7
Total		11936	10229	85.7

TABLE 9

SCHOOL ENROLLMENT

ACCURACY CHECK

School	Zone Location	Beaufort Co. Plan. Comm.	BEAUTS	BEAUTS/BCPC Ratio
Beaufort Elementary	5	393	265	67.4
Beaufort Jr. High	11	930	715	76.9
Robert Smalls Elementary	15	353	389	110.2
Robert Smalls High	15	1228	669	54.5
Battery Creek Elementary	16	515	454	88.2
Beaufort High	24	1387	1244	89.7
Mossy Oaks Elementary	27	714	719	100.7
Port Royal Elementary	34	146	137	93.8
Shell Point Elementary	38	472	407	86.2
Broad River Elementary	48	535	417	77.9
Marine Corps Air Station Grade	55	1033	1011	97.9
Beaufort Academy	64	321	186	57.9
Total		8027	6613	82.4

Note: Several schools not reported because comparable data could not be obtained.

as the comparison of dwelling units and population, no serious errors were thought to exist. A valid reason why the BEAUTS data on employment and school enrollment are lower is that the external survey does not give detailed information on external residents who work or go to school inside the study area. In the external survey it is assumed that all passengers on home-work trips are employed at the same location as the driver. The roadside interviews were conducted during the summer when school was not in session. The difference in school enrollment at Robert Smalls High School and Beaufort Academy can be attributed to the fact that many of these students live outside the study area and therefore are not reported in the BEAUTS data.

Trip Data Checks

The comparison of trip data (expanded from BEAUTS interview surveys) with actual ground count data revealed an under-reporting of trips in the magnitude of 20-25 percent. This was not surprising considering that:

- Complete trip information is not likely regardless of interview method used.
- Lower trip coverage resulted due to use of telephone and obtaining truck trips in the home-telephone interview survey (truck survey not conducted).
- Internal trips made by external residents were not measured.

Screenlines - The two screenlines (shown in Figure 1) were used as the primary check in determining the completeness of the trip data collected in the various surveys. The Beaufort River screenline (Screenline I) follows Brickyard Creek as well as Beaufort River; the Battery Creek screenline (Screenline II) begins at Albergotti Creek and follows an imaginary line to Battery Creek just east of Hogarth Avenue and then along Battery Creek. There are two highway crossings of the Battery Creek

screenline and one crossing of the Beaufort River screenline. Since there were only three crossings involved, screenline interviews for a 14-hour period (6 a.m. - 8 p.m.) were made to provide data on trip purposes and the magnitude of double crossings. The double crossings, as measured in the interviews, were then subtracted from the ground count to provide the adjusted actual crossings. Comparisons of the survey trips with ground count data are shown below for 14-hour and 24-hour totals.

Screenline	Ground Count		Adjusted Ground Count		Survey Trips		Percent Comparison	
	14-hr.	24-hr.	14-hr.	24-hr.	14-hr.	24-hr.	14-hr.	24-hr.
(I) Beaufort River	5857	6500	5857	6500	5105	6236	87.2	95.9
(II) Battery Creek	22392	27000	21445	25858	17533	20693	81.8	80.0

Comparisons of survey trips by hour with adjusted ground count data are presented graphically in Figures 2 and 3. These tabular data are contained in the Appendix (A-8).

Cordon Check

Trips made by internal residents to and from the study area were collected in both the internal and external surveys. A summary of data for the 14-hour interview period yielded the following results:

Type Survey	Trips Crossing Cordon 6 a.m. to 8 p.m.
Internal	3071
External	2904

105.8 percent comparison

The hourly graphic comparison of the two surveys is shown in Figure 4. The supporting data is contained in the Appendix (A-9).

Traffic Assignment Checks

The assignment of survey trips was compared with ground counts to

FIGURE 2

COMPARISON OF TRIPS CROSSING BEAUFORT RIVER SCREENLINE # I

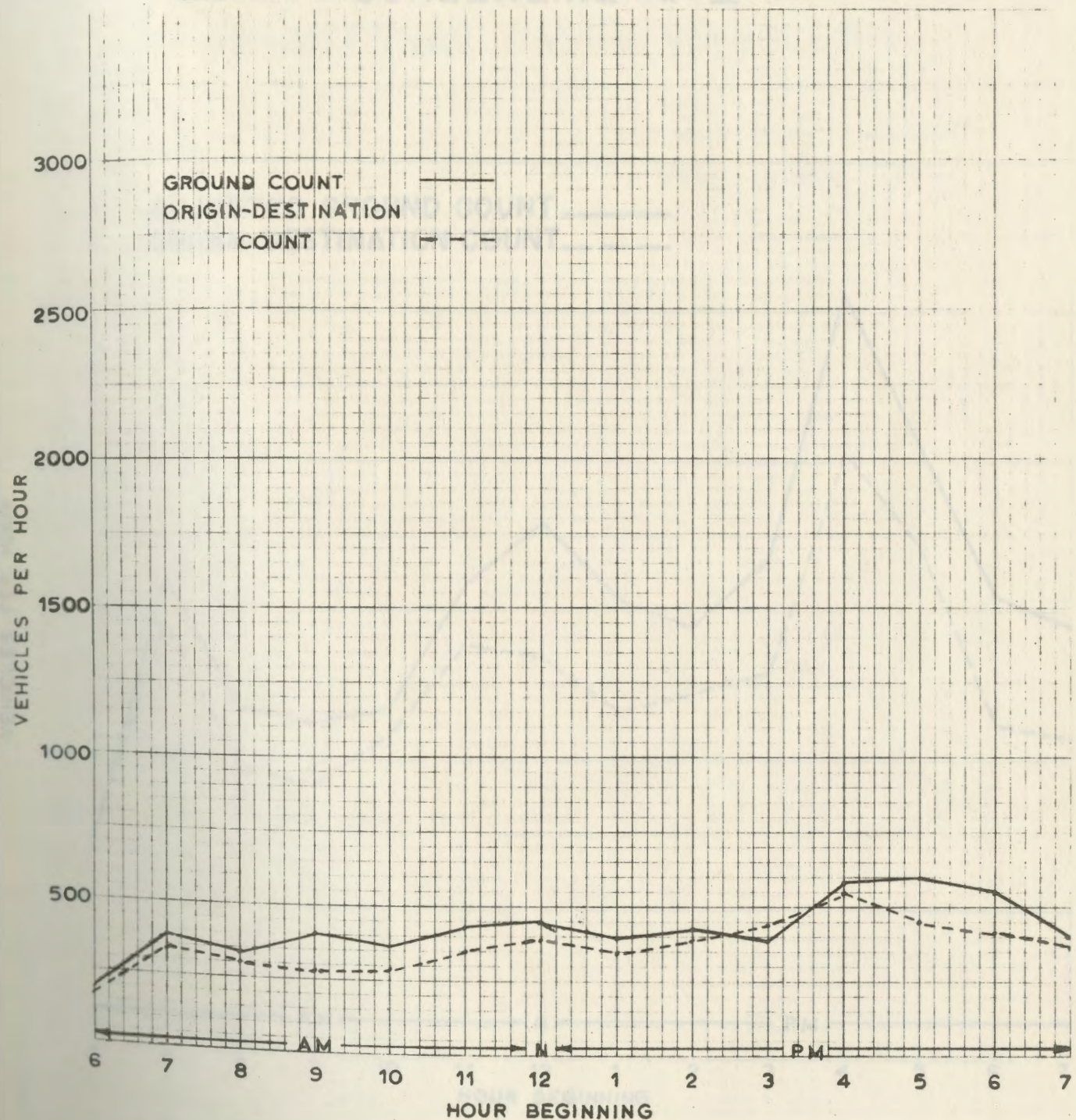


FIGURE 3

COMPARISON OF TRIPS CROSSING BATTERY CREEK SCREENLINE # II

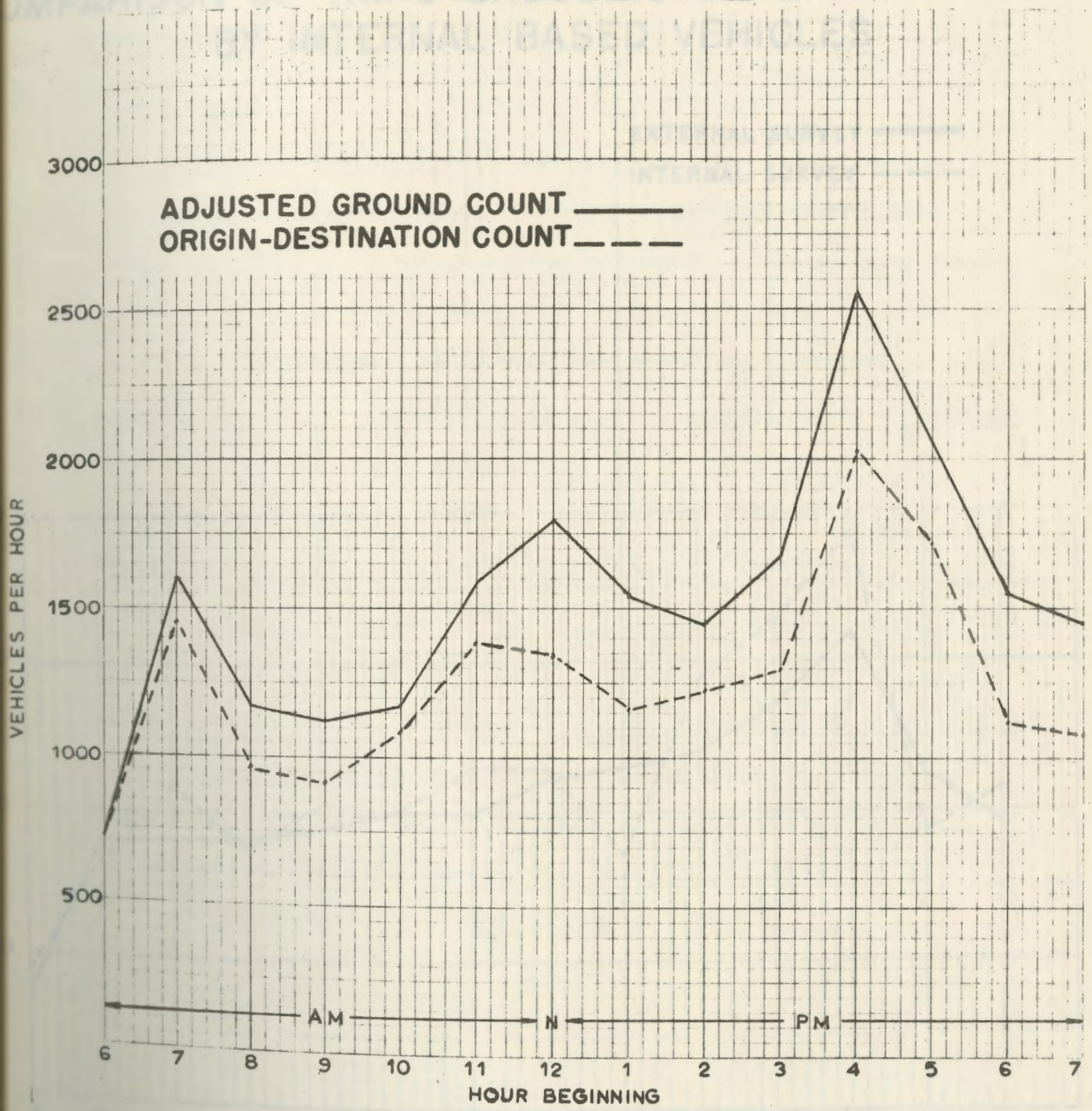
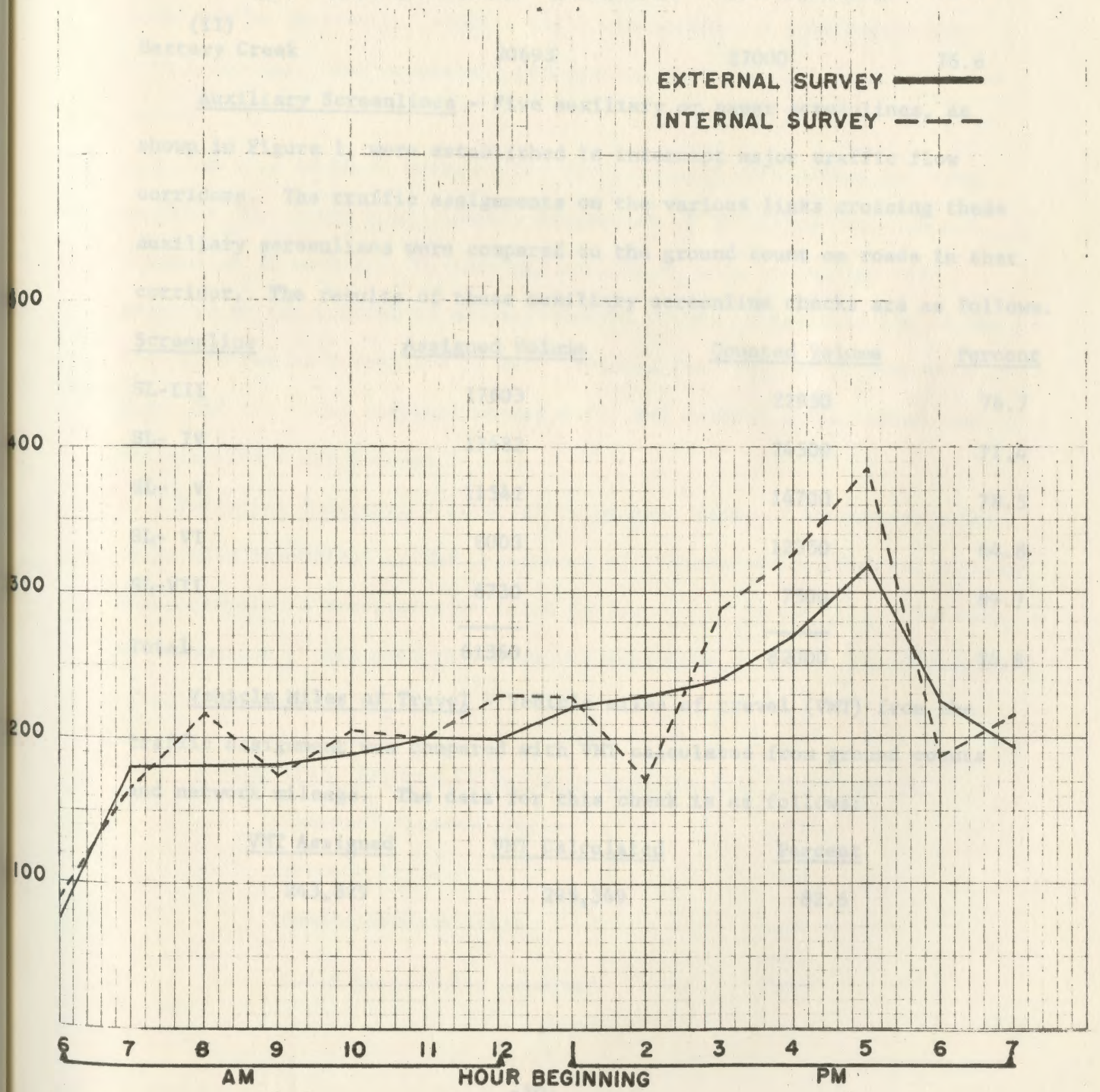


FIGURE 4

COMPARISON OF TRIPS CROSSING EXTERNAL CORDON BY INTERNAL BASED VEHICLES



evaluate the completeness of the vehicle-driver trips collected in BEAUTS.

Primary Screenlines - The comparisons of survey trips with ground counts for a 24-hour period were as follows:

Screenline	24-Hour Assigned Crossings	24-Hour Ground Count	Percent Comparison
(I) Beaufort River	6236	6500	95.9
(II) Battery Creek	20693	27000	76.6

Auxiliary Screenlines - Five auxiliary or paper screenlines, as shown in Figure 1, were established to intercept major traffic flow corridors. The traffic assignments on the various links crossing these auxiliary screenlines were compared to the ground count on roads in that corridor. The results of these auxiliary screenline checks are as follows:

Screenline	Assigned Volume	Counted Volume	Percent
SL-III	17603	22950	76.7
SL- IV	17482	24500	71.4
SL- V	11542	14700	78.5
SL- VI	8003	12350	64.8
SL-VII	6730	7500	89.7
Total	61360	82000	74.8

Vehicle Miles of Travel - Vehicle miles of travel (VMT) from the traffic assignment was compared with VMT calculated from ground counts and network mileage. The data for this check is as follows:

VMT Assigned	VMT Calculated	Percent
243,829	295,349	82.6

Trip Adjustment Factors

It was decided that the vehicle trip information obtained in the home-telephone survey should be adjusted to more nearly simulate ground counts on the existing street and highway network.

Since a high sample rate was used in the external survey, it was assumed that these trips were fully reported and an adjusting factor would not be necessary. Another basic assumption was that homebased-work trips were also accurately reported in the home-telephone interview survey.

The type of trips crossing the two principal screenlines is shown in Table 10. Since approximately 80 percent of the trips that crossed Screenline II were made by internal residents, this screenline was selected as the control to adjust internal trips. Stratification of the trip purposes at Screenline II also compared favorably by purpose with those for the total internal survey trips and further strengthened the decision for control usage.

Factoring Procedure - Internal trips were factored by purpose using techniques prescribed by the Department of Transportation, Federal Highway Administration's memorandum entitled Evaluation of Survey Data. The data at Screenline II was used to derive the expansion factors. The necessary calculations are as follows:

14-Hour Trips Assumed To Be Fully Reported For Screenline II

External-Internal Trips	2927
Through Trips	330
Homebased-Work Trips	4102
Total Trips Fully Reported	7359

TABLE 10

COMPARISON OF SURVEY AREA AND SCREENLINES

24-HOUR PERIOD

Type Trip	Survey		Screenline I		Screenline II	
	Number	Percent	Number	Percent	Number	Percent
Homebased-Work	15143	22.8	727	11.7	4553	22.0
Homebased-Other	24134	36.4	1391	22.3	6973	33.7
Non-Homebased	17463	26.3	673	10.8	5074	24.5
External-Internal	9089	13.7	3029	48.6	3677	17.8
Through	533	.8	416	6.6	416	2.0
Total	66362	100.0	6236	100.0	20693	100.0

Adjusted 14-Hour Ground Counts For Screenline II

Adjusted Ground Count	21445
Less Trips Fully Reported	7359
Total Adjusted Ground Count	14086

14-Hour Reported Trips Crossing Screenline II

Trips Reported Crossing Screenline II	17533
Total Trips Fully Reported	7359
Total Screenline Trips For Adjustment	10174

Overall Adjustment Factor $\frac{14086}{10174} = 1.385$

The adjustment of the internal survey data began by tabulating all internal trips by hour and purpose at Screenline II. Various factors were applied to homebased-other and non-homebased trips and the results compared to the adjusted ground count data. This process continued through many applications of various factors until satisfactory results were achieved between the adjusted trip data and adjusted ground counts both by total and by hour.

After this thorough analysis the adjustment factors that were selected for Screenline II were as follows:

Trip Purpose	Trips Crossing Screenline	Adjustment Factor	Adjusted Trips Crossing Screenline
Homebased-Work	4102	1.0	4102
Homebased-Other	5602	1.3	7283
Non-Homebased	4572	1.5	6858
External-Internal	2927	1.0	2927
External-External	330	1.0	330
Total	17533		21500

Percent Comparison $\frac{21500}{21445} = 100.3$

To check the reasonableness of these factors, they were applied to the total internal survey trips by purpose (see Table 11).

Adjusted Trip Data Checks

Adjustment factors were applied to the internal vehicle driver trips by purpose and a comparison of the factored trips with the ground counts at the screenlines were made.

Screenline Checks - The 14-hour comparison of factored trips with adjusted ground count data produced the following results:

Screenline	14-Hour Adjusted Ground Count	14-Hour Factored Survey Trips	Percent Comparison
(I) Beaufort River	5857	5724	97.7
(II) Battery Creek	21445	21500	100.3

The factored trips, as they are compared with adjusted ground count data, are presented graphically in Figures 5 and 6. Tabulated calculations for the two screenlines are included in the Appendix (A-10).

Assignments - An assignment of the 24-hour factored trips was made to the existing street and highway network. The traffic volume on each link crossing the principal screenlines was totaled and when compared with the ground counts yielded the following results:

Screenline	24-Hour Factored Assignment	24-Hour Ground Count	Percent Comparison
(I) Beaufort River	7006	6500	107.8
(II) Battery Creek	25412	27000	94.1

Assignment volumes crossing the auxiliary screenlines yielded the following comparisons to the ground counts:

TABLE 11

ADJUSTED VEHICLE DRIVER TRIPS

TOTAL STUDY AREA

Trip Purpose	Reported Trips	Factor	Adjusted Trips
Internal Trips			
Homebased-Work	15143	1.0	15143
Homebased-Other	24134	1.3	31374
Non-homebased	17463	1.5	26195
Total Internal Trips	56740		72712
External Trips			
External-Internal	9089	1.0	9089
Through Trips	533	1.0	533
Total External Trips	9622		9622
Total Internals	56740		72712
Total Externals	9622		9622
Total Trips	66362		82334

FIGURE 5

COMPARISON OF FACTORED TRIPS CROSSING BEAUFORT RIVER SCREENLINE # I

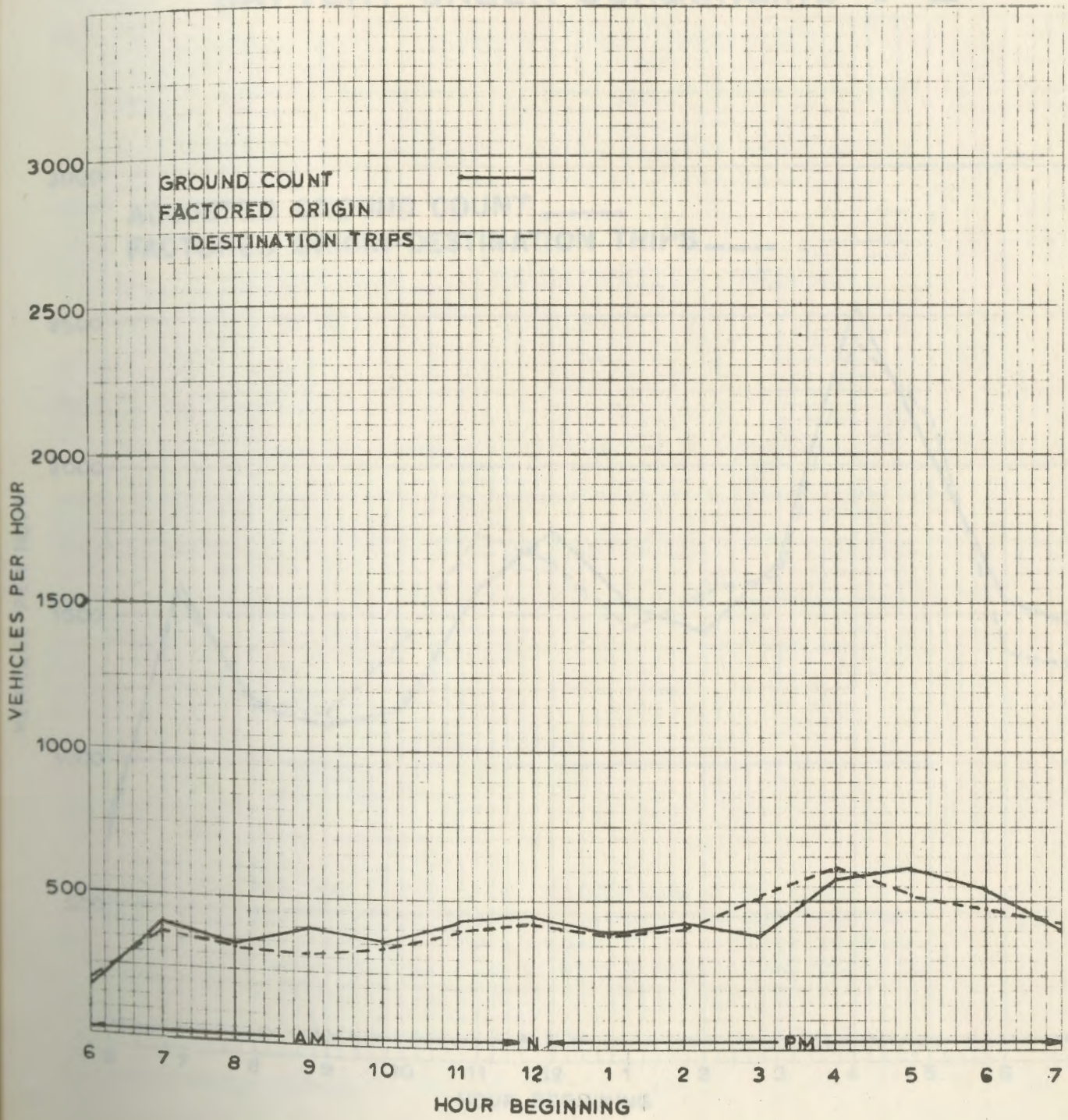
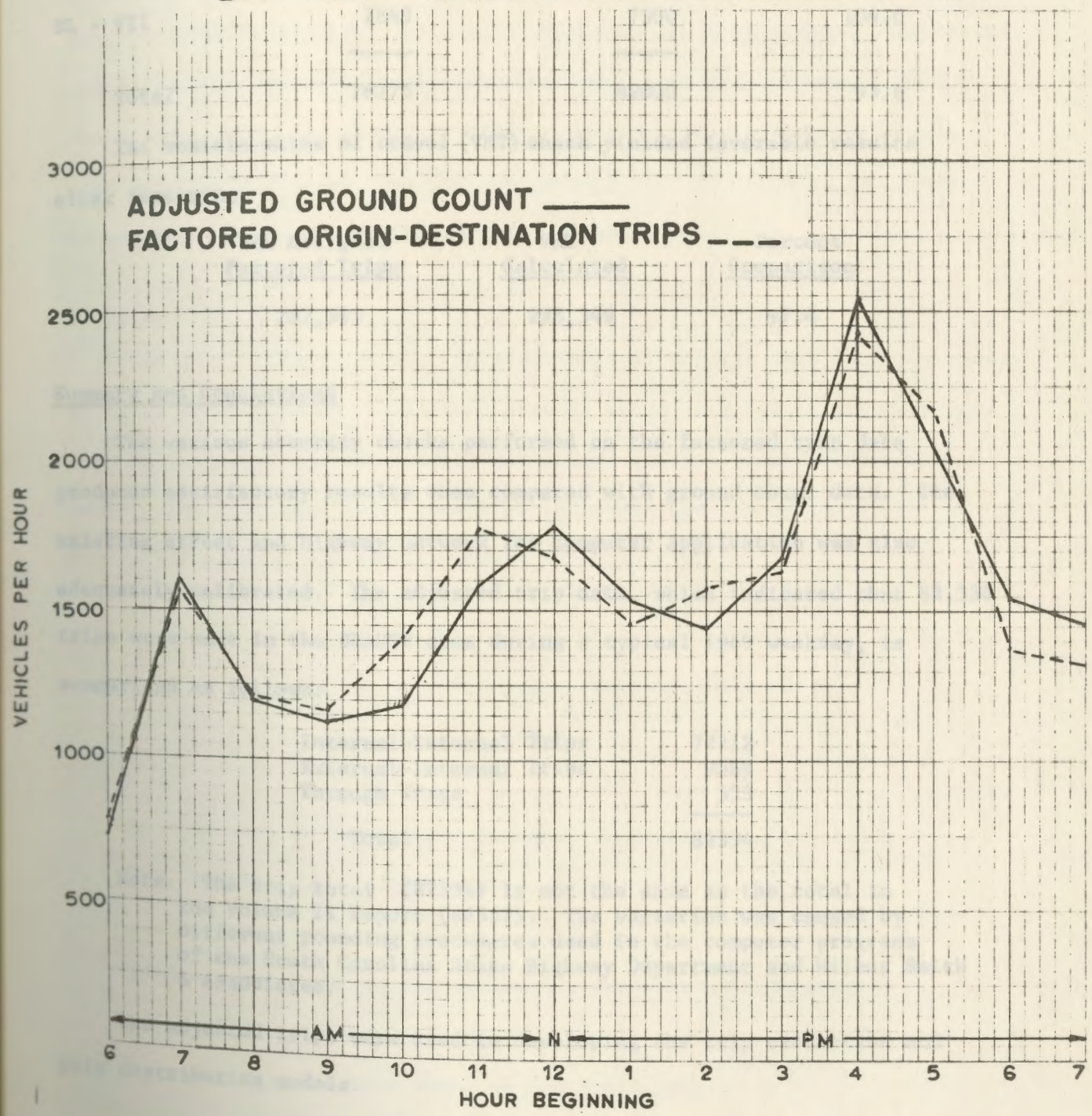


FIGURE 6

COMPARISON OF FACTORED TRIPS CROSSING BATTERY CREEK SCREENLINE # II



Screenline	Assigned Volume	Counted Volume	Percent
SL - III	22107	22950	96.3
SL - IV	22003	24500	89.8
SL - V	14667	14700	99.8
SL - VI	10155	12350	82.2
SL - VII	7843	7500	104.6
Total	76775	82000	93.6

The vehicle miles of travel (VMT) check yielded favorable results after factoring:

VMT Assigned Factored Trips	VMT Calculated	Percent Comparison
287,595	295,349	97.4

Summary and Conclusions

The various accuracy checks performed on the factored trip data produced satisfactory results when compared with ground count data. The existing street and highway network for computer application was also adequately calibrated. The adjusted trip data, which indicated that 82,334 trips were made in the BEAUTS area during a typical 1969 weekday, is summarized as follows:

Internal-Internal Trips	72712
External-Internal Trips	9089
Through Trips	533
Total	82334

Note: The trip total (82334) is not the same as the total in the Volume II Report (82357). The variation was caused by different rounding procedures used in the computer programs of the South Carolina State Highway Department and Wilbur Smith & Associates.

The adjusted trips were used in developing the trip estimation and trip distribution models.

CHAPTER VI

TRIP DISTRIBUTION MODEL

In order to distribute future trips between the various zones and between external stations and internal zones, it is necessary to establish a systematic procedure for relating the present trip purposes to the present distribution of trips. This relationship, when properly calibrated, can distribute future trips by substituting future trip purpose data for the present data. There are several so-called trip distribution models used for this procedure, but the most widely used is based on the theory of gravitation and is justly known as a Gravity Model.

Gravity Model Theory

The gravity model adopts the gravitational concept that the interchange of trips between zones in an urban area is based upon the relative attraction of the zones and the spatial separation (travel time) between the zones. The following model theory is the basis for the synthesis of travel patterns in the Beaufort area:

$$Ti\text{-}j = \frac{Pi\ Aj\ Fi\text{-}j}{\sum_{j=i}^{n} Aj\ Fi\text{-}j}$$

Where:

$Ti\text{-}j$ = total trips produced in zone i and attracted to zone j.

Pi = total trips produced by zone i.

Aj = total trips attracted by zone j.

$Fi\text{-}j$ = travel time factor reflecting the spatial separation between zones i and j.

n = total number of zones in the study area.

The origin-destination and travel time surveys conducted in the BEAUTS area furnished the necessary information concerning productions & attractions, distributions and the actual travel times between the various zones. Thus the only remaining unknown in the equation is the travel time factor.

Travel and Terminal Times

In order to better simulate actual conditions for use in the gravity model program, the traffic assignment network was updated through the addition of intrazonal travel times and terminal times entered through the skim trees program. The intrazonal travel times were calculated by averaging the travel time for the zone centroid connectors for each of the 68 internal zones. These travel times are shown in Table 12. The terminal time for each zone is a measure of the parking time and the necessary walking time to get to a prescribed location. These times would necessarily be larger for the CBD zone and other zones where parking is not readily available adjacent to the trip maker's ultimate destination. The terminal times for the Beaufort area are shown in Table 12. Once the network had been updated with this information, it was ready to be used as input to the gravity model program.

Model Purposes

Prior to development of the gravity model, the trip length frequencies were analyzed for the following purposes for trips from both military (Marine Corps Air Station, Parris Island and Laurel Bay) and non-military zones:

Homebased-Work	Non-Homebased
Homebased-Other	External-Internal

TABLE 12

INTRAZONAL TRAVEL TIMES

Zone	0	1	2	3	4	5	6	7	8	9
0		10	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1
2	2	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	40	2	1
4	2	2	1	1	1	1	1	1	1	2
5	1	1	1	40	2	40	2	2	2	2
6	2	2	2	2	2	2	2	1	2	

Note: Zones 37, 53 and 55 have high intrazonal times (40) because intrazonal trips were not collected in these zones. Zone 01 is the CBD.

TERMINAL TIMES

Zone	0	1	2	3	4	5	6	7	8	9
0		3	1	1	1	1	2	2	1	1
1	1	2	1	1	1	1	1	1	1	1
2	2	1	1	1	1	1	1	1	1	1
3	1	2	2	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	

Note: Wilbur Smith & Associates' model uses only intrazonal time for distributing intra trips.

Since, from examination of the trip length frequency curves, there were no apparent differences among the various purposes it was decided to use only two models - one model to distribute trips from the military installations and the other to distribute trips from all other zones.

Travel Time Factors

The travel time factors represent an approximation of the relative trip distribution rates between a specified zone and all zones in a study area. These factors are first estimated and then adjusted on each successive calibration of the gravity model until the trip length distribution relatively matches that of the O-D data. The final factors used in the calibrated model are shown in Table 13.

Calibration Results and Comparisons

These travel time factors together with all the parameters on the right side of the gravity model equation, were used to obtain estimates of zonal interchanges in the BEAUTS study.

Comparisons of average trip length and vehicle hours of travel as determined from O-D data and derived from the calibrated gravity model are shown in Figures 7 & 8 and are summarized as follows:

Trip Purpose	Average Trip Length		Ratio GM/OD	Vehicle Hours of Travel		Ratio GM/OD
	OD	GM		OD	GM	
Non-Military	11.3	11.1	.98	13193	13065	.99
Military	15.0	15.5	1.03	2929	3026	1.03

Network Comparisons

Following these calibration checks, the gravity model (GM) and origin-destination (O-D) trip interchanges were assigned to the existing street network and tested statistically. Table 14 shows the results of the link volume comparison test.

TABLE 13

FINAL TRAVEL TIME FACTORS

Trip Length (Minutes)	Non Military Total	Military Total
1	9600	*
2	9400	*
3	9000	*
4	6500	*
5	4300	3400
6	3300	4000
7	2500	4500
8	2100	4800
9	1800	4600
10	1600	4300
11	1350	2800
12	1200	1800
13	1050	1400
14	950	1050
15	860	820
16	780	680
17	720	610
18	650	560
19	600	520
20	550	500
21	500	580
22	460	570
23	430	560
24	390	555
25	360	550
26	340	550
27	310	540
28	290	530
29	265	520
30	245	510
31	230	500
32	210	490
33	200	480
34	185	470
35	175	460
36	165	450
37	150	440
38	140	430
39	135	420
40	125	410

* Wilbur Smith and Associates' model uses only intrazonal time for distributing intra trips. Non-military has 1 minute intrazonal time and military has 40 minutes intrazonal time (no intra trips were picked up from survey); therefore the lowest time on curve will be terminal time on both ends plus driving time.

FIGURE 7

TRIP LENGTH DISTRIBUTION

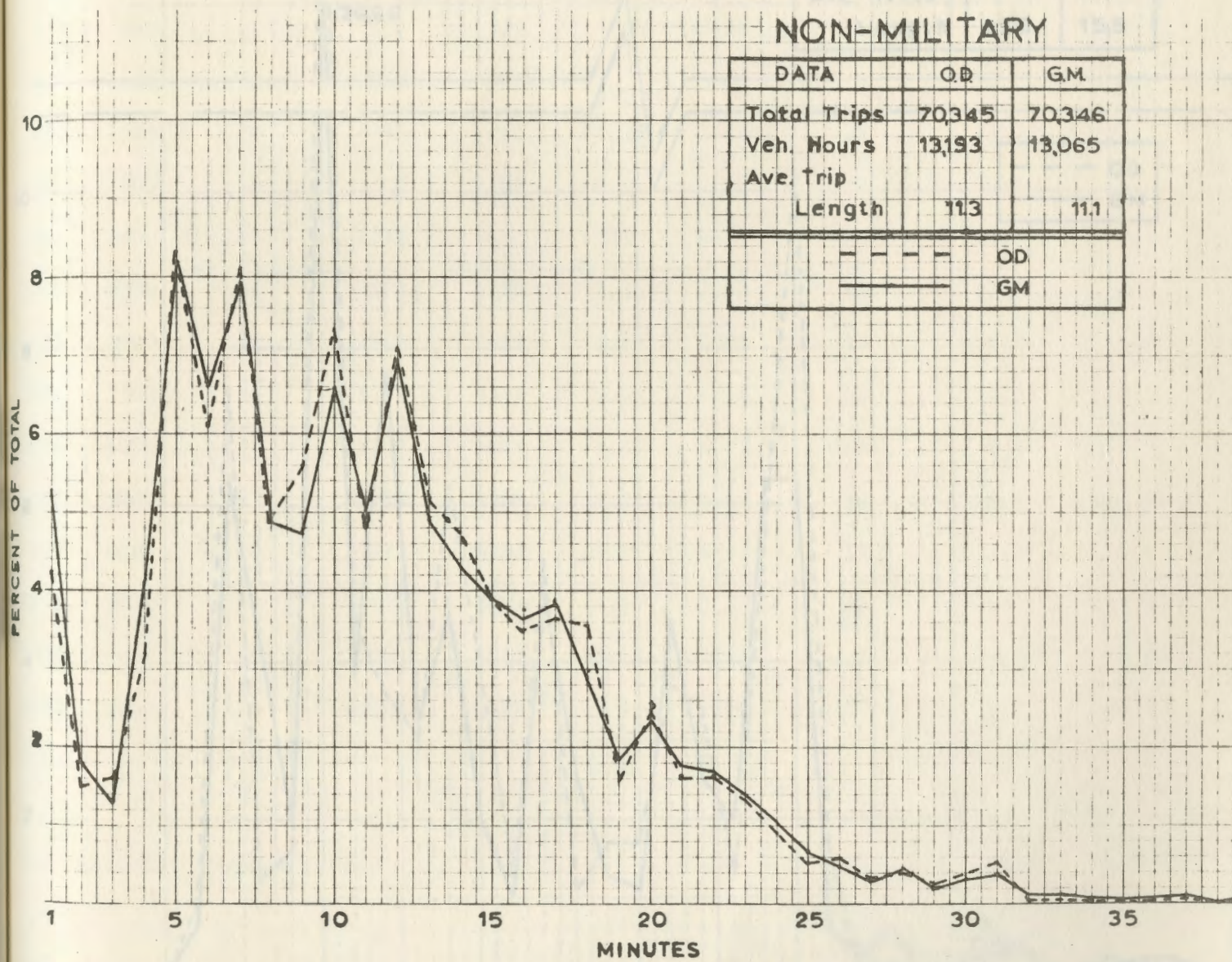


FIGURE 8

TRIP LENGTH DISTRIBUTION

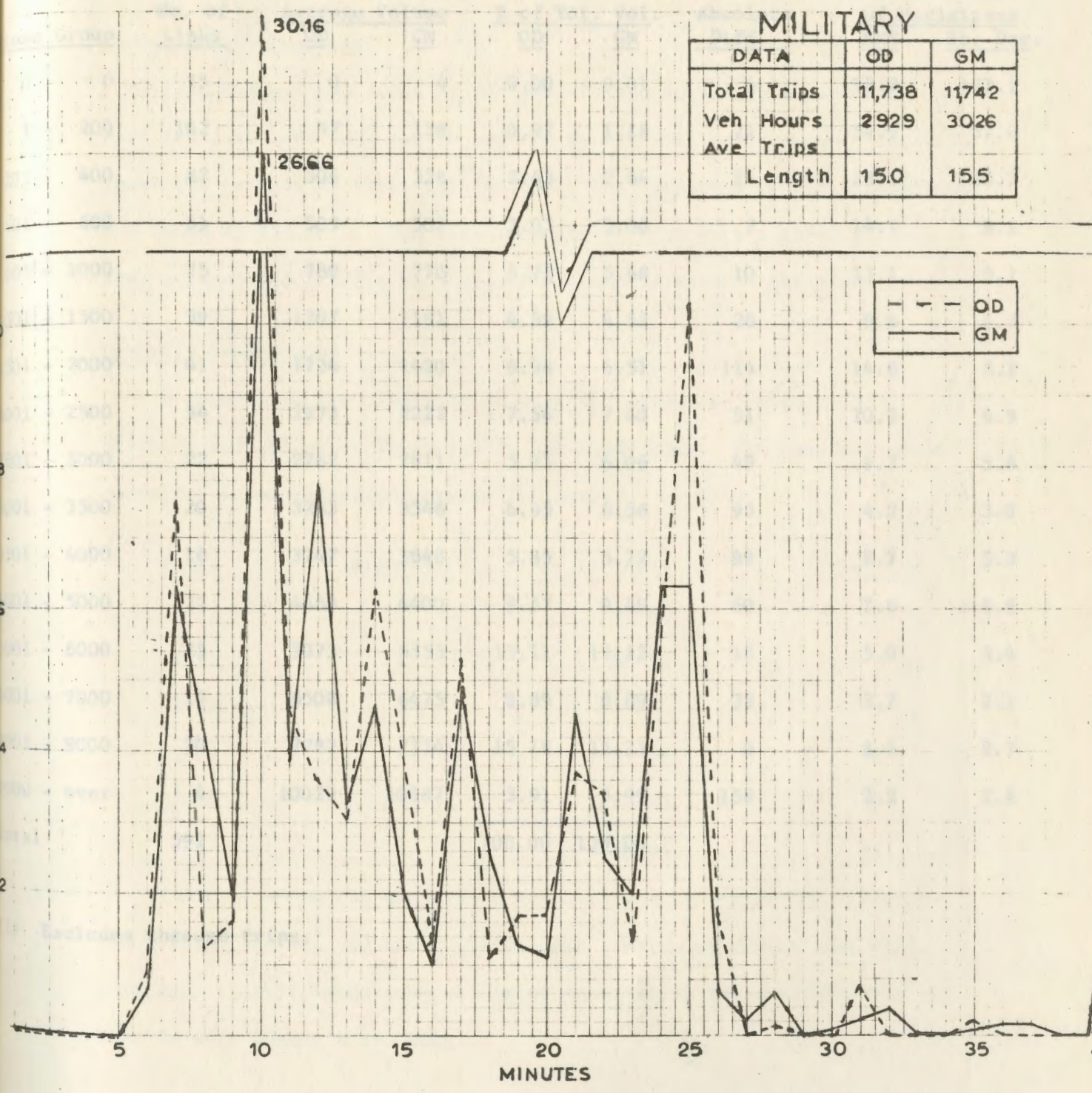


TABLE 14

COMPARISON OF O-D AND GM ASSIGNMENTS[1] TO EXISTING NETWORK

Volume Group	No. of Links	Average Volume		% of Tot. Vol.		Absolute Diff.	Coefficients Of Variations	
		OD	GM	OD	GM		RMS	St. Dev.
0 - 0	15	0	4	0.00	0.01	4	198.2	177.1
1 - 200	102	97	118	0.97	1.18	21	54.9	37.6
201 - 400	82	304	328	2.43	2.64	24	28.1	20.7
401 - 600	61	509	502	3.03	3.00	7	14.1	9.1
601 - 1000	75	780	770	5.71	5.66	10	13.1	8.1
1001 - 1500	39	1207	1181	4.59	4.52	26	9.6	6.7
1501 - 2000	41	1734	1620	6.94	6.51	114	14.6	8.2
2001 - 2500	34	2273	2222	7.54	7.40	51	10.3	4.9
2501 - 3000	22	2762	2811	5.93	6.06	49	9.7	5.6
3001 - 3500	20	3253	3346	6.35	6.56	93	4.2	3.0
3501 - 4000	16	3747	3648	5.85	5.72	99	8.7	5.3
4001 - 5000	22	4460	4400	9.57	9.49	60	7.6	4.8
5001 - 6000	25	5373	5355	13.11	13.12	18	5.0	3.4
6001 - 7000	14	6508	6475	8.89	8.89	33	3.7	2.1
7001 - 9000	20	7782	7774	15.18	15.25	8	6.5	2.7
9000 - over	4	10029	10187	3.91	3.99	158	3.2	2.6
Total	592			100.00	100.00			

(1) Excludes through trips.

The percent RMS error was plotted against the volume groups and compared to the percent dwelling unit sample. The results of this test showed this data to be comparable with results in other similar studies.

Screenline Comparisons

Assigned volumes crossing the primary and auxiliary screenlines were tabulated for both the GM and the O-D traffic assignments. Table 15 shows the results of these tabulations. The locations of the screenlines are shown in Figure 1. The auxiliary screenlines were located so that they intercepted traffic flow in the major corridors of the study area.

District Comparisons

A comparison was tabulated showing the movements between each district and all other districts in the study area. The internal zones contained in each district are as follows:

Zones	District	Zones	District
01-11	1	38-42	7
12-14	2	43-52	8
15-20	3	53	9
21-25	4	54-59	10
26-36	5	60-63	11
37	6	64-68	12

Table 16 shows the comparison of these district-district trips for the O-D and the GM, and their differences. While no statistical tests were made of this comparison, a visual examination was conducted and the results were deemed acceptable.

TABLE 15

SCREENLINE COMPARISONS OF O-D AND GM LOADED NETWORKS

	OD	GM	GM/OD
Primary Screenlines			
I	6588	7331	1.11
II	24994	25361	1.01
Sub-Total	31582	32692	1.04
Auxiliary Screenlines			
III	21689	21741	1.00
IV	22088	22139	1.00
V	14696	13868	.94
VI	10184	9682	.95
VII	7551	6607	.87
Sub-Total	76208	74037	.97
Total All Screenlines	107790	106729	.99

TABLE 16

DISTRICT TO DISTRICT

TRIP COMPARISON

Low District	High District	OD	GM	Diff.
1	1	6076	5731	- 345
	2	3519	3903	+ 384
	3	2440	1918	- 522
	4	2130	1697	- 433
	5	2385	2395	+ 10
	6	626	855	+ 229
	7	701	854	+ 153
	8	3148	2998	- 150
	9	1227	1386	+ 159
	10	972	1498	+ 526
	11	269	329	+ 60
	12	1174	1290	+ 116
2	2	999	1230	+ 231
	3	514	664	+ 150
	4	724	571	- 153
	5	1161	821	- 340
	6	362	312	- 50
	7	427	314	- 113
	8	1496	1498	+ 2
	9	996	835	- 161
	10	688	521	- 167
	11	51	91	+ 40
	12	204	343	+ 139
3	3	549	476	- 73
	4	638	740	+ 102
	5	614	874	+ 260
	6	181	267	+ 86
	7	156	199	+ 43
	8	427	695	+ 268
	9	559	372	- 187
	10	189	302	+ 113
	11	35	57	+ 22
	12	200	199	- 1
4	4	1001	1167	+ 166
	5	2500	2414	- 86
	6	433	647	+ 214
	7	398	352	- 46
	8	760	688	- 72
	9	408	417	+ 9
	10	213	353	+ 140
	11	77	64	- 13
	12	159	207	+ 48
5	5	3862	4032	+ 170
	6	2174	1974	- 200
	7	724	1065	+ 341
	8	1382	1170	- 212
	9	993	677	- 316
	10	584	700	+ 116
	11	47	107	+ 60
	12	264	336	+ 72
6	6	0	193	+ 193
	7	1248	1058	- 190
	8	794	730	- 64
	9	433	449	+ 16
	10	1165	671	- 494
	11	61	75	+ 14
	12	51	166	+ 115
7	7	840	831	- 9
	8	1110	857	- 253
	9	631	508	- 123
	10	261	336	+ 75
	11	43	34	- 9
	12	49	97	+ 48
8	8	2671	2662	- 9
	9	2562	2818	+ 256
	10	1802	2142	+ 340
	11	95	111	+ 16
	12	316	344	+ 28
9	9	0	142	+ 142
	10	4179	3814	- 365
	11	26	89	+ 63
	12	300	220	- 80
10	10	1267	1047	- 220
	11	49	92	+ 43
	12	78	208	+ 130
11	11	232	157	- 75
	12	247	111	- 136

TABLE 16 (CON'T.)

DISTRICT TO DISTRICT

TRIP COMPARISON

District	District	OD	GM	Diff.
12	12	630	402	- 228
Subtotals		72956	72969	+ 13
External Stations	1	2032	2184	+ 152
	2	749	553	- 196
	3	489	307	- 182
	4	383	341	- 42
	5	811	782	- 29
	6	838	766	- 72
	7	293	396	+ 103
	8	1264	1149	- 115
	9	745	1192	+ 447
	10	801	802	+ 1
	11	122	100	- 22
	12	600	547	- 53
Subtotals		9127	9119	- 8
Totals		82083	82088	+ 5

Summary and Conclusions

The results of the various tests conducted on the synthetic data received from the gravity model indicate that the model is properly calibrated and will reliably distribute present trips. The trip length distribution test showed an error of about three percent on each of the two models. Tests on the loaded network indicate that although the links are not comparable at each end of the volume groups, the volume groups containing the most trips are within acceptable limits. Since the gravity model has reliably distributed present data in the Beaufort area, it is concluded that future travel patterns will also be reliably distributed, assuming that relative distribution rates will remain constant over time.

CHAPTER VII

TRIP GENERATION

The multiple regression analysis is a process whereby mathematical equations are developed, using current socio-economic data, to represent the survey year trip ends. When these relationships are established, future planning data is then substituted and the equations are solved for future trip ends. Once again, as in trip distribution, the factors determining productions and attractions are assumed to remain constant throughout time.

Program Theory

The multiple linear regression program BMD02R, originally prepared for biomedical use, was used to develop the mathematical model. This analysis determines the relationship between a dependent variable and an array of independent variables leading to a linear equation best describing this relationship. This equation is in the form of:

$$Di = B_1 X_{1i} + B_2 X_{2i} + - - - - B_n X_{ni} + C$$

Where:

Di = Value of the dependent variable for each zone i (productions or attractions).

X_{1i} = Value of the independent variable for each zone i (socio-economic and land use data).

B_i = Coefficients relating to each variable.

C = A constant to balance the predicted value of the independent variables selected with the dependent variable.

The program uses a statistical test (F ratio) to determine the most significant independent variable from among those being considered and

either adds a given variable to the equation or indicates that it is not sufficiently significant to be included. This process is outlined as follows:

1. The independent variables being considered are ranked in order of their significance to the dependent variable under consideration.
2. The most significant independent variable is selected and a regression equation using it is developed.
3. The remaining independent variables are re-classified in order of their significance.
4. The most significant of the remaining independent variables is selected and a new equation is written containing the previously selected variable.
5. This process is continued until all significant independent variables meeting the stipulated criteria are selected.

Computer Analysis

In order to implement this process, it was necessary to supply as input to this program certain socio-economic data collected in the transportation study and land use data furnished by the Planning Commission. Table 17 shows this data and the mean zonal value for each variable.

For the computer run, 57 of the total 68 zones were used and equations developed for each of the 11 dependent variables. Treatment of the remaining 11 special zones will be discussed later in this chapter. A comparison was made between the observed and predicted values using the total production and total attraction equations. It was decided that only the total equations for both productions & attractions and external-internal attractions would be used for estimating future trip ends. Table 18 shows the equations selected.

TABLE 17

VARIABLES FOR TRAFFIC MODEL DEVELOPMENT

	57 Zones	
Dependent Variables	Mean	Std. Dev.
1. Homebased-Work Prod. (HBW P)	191	178
2. Homebased-Other Prod. (HBO P)	403	370
3. Non-homebased Prod. (NHB P)	310	275
4. Combination Prod. (Comb P)*	713	535
5. Total Prod. (Tot P)	904	669
6. Homebased-Work Attr. (HBW A)	69	77
7. Homebased-Other Attr. (HBO A)	340	325
8. Non-homebased Attr. (NHB A)	321	288
9. Combination Attr. (Comb A)*	662	591
10. External-Internal Attr. (E-I A)	97	81
11. Total Attr. (Tot A)	828	710
Independent Variables		
12. Dwelling Unit (DU)	114	76
13. Population (Pop)	380	261
14. Automobile (Auto)	143	117
15. Employment (Emp)	63	61
16. School Attendance (Sch Att)	132	331
17. Retail Sales (Ret Sale)	372	640

* Combination Productions and Attractions are a combination of Homebased-Other and Non-homebased.

TABLE 18

LINEAR REGRESSION EQUATIONS

FOR ZONAL TRIP ENDS

Production Equations

1. HBW P = 1.38 (Auto) - 6.09

2. HBO P = 2.96 (Auto) -18.62

3. NHB P = 2.84 (Emp) + .12 (Ret Sale) + 84.11

** 4. Comb P = 2.92 (Auto) + 4.35 (Emp) + 22.06

* 5. Tot P = 4.28 (Auto) + 4.50 (Emp) + 9.78

Attraction Equations

6. HBW A = 1.04 (Emp) + 2.88

7. HBO A = 2.03 (Emp) + .16 (Ret Sale) + 152.06

8. NHB A = 2.92 (Emp) + .13 (Ret Sale) + 87.73

** 9. Comb A = 1.54 (DU) + 3.94 (Emp) + .35 (Ret Sale) + 108.07

* 10. E-I A = .39 (DU) + .65 (Emp) + .04 (Ret Sale) - 2.44

* 11. Tot A = 1.75 (DU) + 5.64 (Emp) + .39 (Ret Sale) + 124.74

* Equations used

** Comb P & A equations are a combination of HBO and NHB.

A general procedure to be followed in using the regression equations is as follows:

1. Solve all equations (using rate analysis where necessary).
2. Using the total equations, apply logic and judgement to solution for each zone and derive control totals (by zone and totals).
3. Balance total attractions to total productions.
4. For productions and attractions balance each purpose to its control total by zone.
5. Code and punch trip ends for input to Gravity Model.

Note: Project work file contains work sheets used in computing future trip ends.

Statistical tests were conducted on each equation following the selection of each new independent variable. The multiple correlation coefficient (R) signifies how well the results of each equation involving independent variables correlates with the known value of the dependent variable. The standard error is an indicator of the dispersion of the data about the regression curve. The percent error expressed as a ratio of the mean of the dependent variable to the standard error of estimate is known as the coefficient of variation. Table 19 shows the results of these statistical tests on the selected regression equations.

Treatment of Special Zones

Eleven (11) zones were removed from the regression analysis because of their unique characteristics and required special treatment. These

TABLE 19

EQUATION STATISTICS

Regression Equation	Mean	Multiple Correlation Coefficient (R)	Standard Error of Estimate	Coefficient of Variation
HBW P	191	0.9115	73.7585	38.6
HBO P	403	0.9367	130.7789	32.4
NHB P	310	0.8459	149.4791	48.3
** Comb P	713	0.9179	216.0092	30.3
* Tot P	904	0.9545	203.1688	22.5
HBW A	69	0.8244	44.0835	64.1
HBO A	340	0.6364	254.9635	74.9
NHB A	321	0.8384	159.9692	49.8
** Comb A	662	0.7781	381.6018	57.7
* E-I A	97	0.8937	37.2531	38.3
* Tot A	828	0.8308	405.9343	49.0

* Equations used

** Comb P & A equation statistics are a combination of HBO and NHB.

zones are listed below:

Zone	Special Characteristics
01	CBD
20	Beaufort Memorial Hospital
31	Royal Oaks Shopping Center
32	Naval Hospital
37	Parris Island
41	Proposed High School Location
43	Beaufort Plaza Shopping Center
53	Marine Corps Air Station
54	Industrial Zone
55	Laurel Bay (Military Housing)
56	Industrial Zone

It was considered if these zones were allowed to remain in the analysis, inaccurate results would occur.

The following process was used to analyze each of the 11 special zones:

(a) An analysis of the present trips was made to determine the primary trip making characteristics of the zone.

(b) These characteristics were then compared to the future characteristics to see if the composition of the zone had changed appreciably.

(c) Various planning data variables were selected to determine future total trips for the zone. In the military zones a 1.25 factor was used.

(d) The future productions and attractions were then ready for distribution by the gravity model.

Summary and Conclusions

Tests and comparisons indicate that the regression equations, as developed, will adequately predict future trip ends within limits established by the accuracy of the socio-economic and land use data. The independent variables selected by the analysis are all readily predictable.

CHAPTER VIII

EXTERNAL TRIP PROJECTIONS

The procedure used in projecting external-internal travel for the Beaufort area was based on average growth. Average growth is an average of the population growth rates of the external areas and the study area. This average growth rate is applied to other factors affecting increased travel to arrive at a combined factor. The 1990 trips are obtained by multiplying the combined factor by the 1969 external trips between the external zone and the internal area. Future through trips were projected by using growth factors.

External-Internal Trips

Final results showed that 9095 trips (11 percent of the total daily trips) were of the external-internal type. In order to estimate the future trip ends of external-internal travel, a combined growth factor was derived for each South Carolina county and for various sections of the United States. These factors were then applied to the 1969 trips recorded for each area to estimate 1990 trips. Table 20 gives the steps that were used in obtaining the combined factors and Table 21 shows how the 1990 external-internal trips were derived.

Through Trips

External trips passing through the BEAUTS area account for less than six percent of the total 1969 trips using the three highways entering the study area. The Fratar Growth Factor Program was used to distribute the through trips for 1990.

Growth factors were obtained for each of the three external stations for these external-external trips. The growth factor was calculated by obtaining the difference of the established 1990 station volume and the

TABLE 20

TRIP INCREASE FACTORS -- EXTERNAL-INTERNAL

SOUTH CAROLINA COUNTIES AND OUT-OF-STATE

County	County Population Growth (1)	Population Growth Average (2)	Vehicle Ownership Factor (3)	Attraction Factor (4)	Combined Factor
Abbeville	.86	1.21	1.21	1.15	1.68
Aiken	1.59 *	1.58	1.21	1.10	2.10
Allendale	1.02	1.29	1.21	1.15	1.79
Anderson	1.20	1.38	1.21	1.05	1.75
Bamberg	.83	1.20	1.21	1.15	1.67
Barnwell	1.17	1.37	1.21	1.15	1.91
Beaufort	1.56 **	1.56	1.21	1.15	2.17
Berkeley	1.63	1.60	1.21	1.15	2.23
Calhoun	.59	1.08	1.21	1.10	1.44
Charleston	2.05	1.81	1.21	1.15	2.52
Cherokee	.99	1.28	1.21	1.05	1.63
Chester	.86	1.21	1.21	1.05	1.53
Chesterfield	.79	1.18	1.21	1.05	1.50
Clarendon	.79	1.18	1.21	1.10	1.57
Colleton	1.00	1.28	1.21	1.15	1.78
Darlington	1.14	1.35	1.21	1.10	1.79
Dillon	.93	1.25	1.21	1.10	1.66
Dorchester	1.17	1.37	1.21	1.15	1.91
Edgefield	.81	1.19	1.21	1.10	1.58
Fairfield	.83	1.20	1.21	1.10	1.60
Florence	1.14	1.35	1.21	1.10	1.79
Georgetown	1.19	1.38	1.21	1.10	1.84
Greenville	1.46	1.51	1.21	1.05	1.92
Greenwood	1.00	1.28	1.21	1.10	1.70
Hampton	.99	1.28	1.21	1.15	1.78
Horry	1.22	1.39	1.21	1.10	1.85
Jasper	1.41	1.49	1.21	1.15	2.07
Kershaw	1.08	1.32	1.21	1.05	1.68
Lancaster	1.06	1.31	1.21	1.05	1.67
Laurens	.99	1.28	1.21	1.05	1.63
Lee	.93	1.25	1.21	1.10	1.66
Lexington	1.72	1.64	1.21	1.10	2.18
McCormick	.80	1.18	1.21	1.10	1.57
Marion	.93	1.25	1.21	1.05	1.59
Marlboro	.82	1.19	1.21	1.05	1.51
Newberry	.83	1.20	1.21	1.10	1.60
Oconee	1.01	1.29	1.21	1.05	1.64
Orangeburg	.97	1.27	1.21	1.10	1.69
Pickens	1.28	1.42	1.21	1.05	1.81
Richland	1.78	1.67	1.21	1.10	2.22
Saluda	.74	1.15	1.21	1.10	1.53
Spartanburg	1.48 *	1.52	1.21	1.05	1.93
Sumter	1.38	1.47	1.21	1.10	1.96
Union	.95	1.26	1.21	1.05	1.60
Williamsburg	.83	1.20	1.21	1.10	1.60
York	1.17	1.37	1.21	1.05	1.74

TABLE 20 (CONT'D.)

TRIP INCREASE FACTORS -- EXTERNAL-INTERNAL

SOUTH CAROLINA COUNTIES AND OUT-OF-STATE

Out-of-State Direction	County Population Growth	Population Growth Average	Vehicle Ownership Factor	Attraction Factor	Combined Factor
Northeast	1.30	1.43	1.21	1.20	2.07
North	1.32	1.44	1.21	1.20	2.09
Northwest	1.29	1.42	1.21	1.20	2.06
Southwest	1.58	1.57	1.21	1.20	2.28
Southeast	1.68	1.62	1.21	1.20	2.35

* Adjusted

** Derived from 1969 Planning Data

(1) Derived from U.S.Census estimates (used SUATS Population Growth figures).

(2) Average of the county or states' growth and the study area growth at 1.56.

(3) Based on linear projection of increased vehicle ownership in South Carolina.

(4) Based on studies of increased travel influenced by new highways and the proximity of the study area to the county.

TABLE 21

1990 EXTERNAL-INTERNAL PROJECTIONS

SOUTH CAROLINA COUNTIES AND OUT-OF-STATE

County	1969 Trips	Combined Factor	1990 Trips
Aiken	6	2.10	13
Allendale	68	1.79	122
Anderson	1	1.75	2
Bamberg	19	1.67	32
Barnwell	20	1.91	38
Berkeley	5	2.23	11
Calhoun	2	1.44	3
Charleston	614	2.52	1547
Chesterfield	2	1.50	3
Clarendon	4	1.57	6
Colleton	325	1.78	578
Darlington	1	1.79	2
Dillon	9	1.66	15
Dorchester	15	1.91	29
Florence	17	1.79	30
Georgetown	5	1.84	9
Greenville	6	1.92	12
Hampton	465	1.78	828
Horry	12	1.85	22
Jasper	533	2.07	1103
Kershaw	3	1.68	5
Laurens	5	1.63	8
Lexington	9	2.18	20
Marion	1	1.59	2
Newberry	2	1.60	3
Orangeburg	59	1.69	100
Pickens	1	1.81	2
Richland	89	2.22	198
Saluda	2	1.53	3
Spartanburg	11	1.93	21
Sumter	13	1.96	25
Union	5	1.60	8
Williamsburg	1	1.60	2
York	2	1.74	3
Sub-total	2332		4805

TABLE 21 (CONT'D.)

1990 EXTERNAL-INTERNAL PROJECTIONS

SOUTH CAROLINA COUNTIES AND OUT-OF-STATE

Beaufort County External Zones	1969 Trips	Combined Factor	1990 Trips
* 713001	889	2.17	1929
* 713002	230	2.17	499
* 713003	1681	2.17	3648
* 713004	454	2.17	985
713005	-		-
713006	277	2.17	601
713007	620	2.17	1345
713008	287	2.17	623
* 713009	184	2.17	399
* 713010	24	2.17	52
* 713011	1	2.17	2
* 713012	129	2.17	280
* 713013	256	2.17	556
* 713014	146	2.17	317
* Additional trips to account for industrial areas outside BEAUTS. These trips are projected for Fripp Island, Hilton Head Island and Port Victoria area.			3400
Subtotal	5178		14636
Out-of-State - Direction			
Northeast	81	2.07	168
North	9	2.09	19
Northwest	11	2.06	23
Southwest	18	2.28	41
Southeast	1466	2.35	3445
Sub-total	1585		3696
Total	9095		23137

projected 1990 external-internal volume. The growth factor for each station is as follows:

	Station		
	69 (US 21)	70 (US 21)	71 (SC 170)
Growth Factor	3.12	2.68	1.90

The through trips increase from 533 to more than 1400 by 1990. The largest through movement takes place within the US 21 corridor - from 271 trips a day in 1969 to about 900 trips by 1990.

APPENDIX

MEMORANDUM OF AGREEMENT BETWEEN SOUTH CAROLINA
STATE HIGHWAY DEPARTMENT AND BEAUFORT COUNTY
FOR BEAUFORT AREA TRANSPORTATION STUDY

THIS AGREEMENT, made this 15th day of May, 1969 by and between the South Carolina State Highway Department, hereinafter called "the Highway Department" and Beaufort County, hereinafter called "the County".

WITNESSETH:

WHEREAS, the Highway Department and the County desire to cooperatively and jointly undertake a comprehensive transportation study and to develop a long range street and highway plan for the Beaufort & Port Royal metropolitan areas and to maintain the compatibility of the plan with desired community development goals

NOW THEREFORE, in consideration of the foregoing, the parties agree as follows:

I. Study Objectives

The objectives of the study will be to:

A. Establish a permanent, continuing, comprehensive transportation planning process to be carried on cooperatively by the local community and the Highway Department.

B. Develop present and projected travel desires and patterns within and through the study area.

C. Prepare a long range plan for the development, improvement and usage of streets and highways in the study area to serve travel desires projected through the design year.

2. Study Area

The initial study area includes the incorporated municipalities of Beaufort and Port Royal and the other surrounding areas located on Port Royal, Ladies and Paris Islands. The study area contains all of the land expected to be built up or urbanized by the design year. If found necessary to contain the developing community, the study area will be expanded in the future, by mutual agreement.

3. Design Year

The year 1990 will be the initial design year for the purposes of projecting population, land use, economic and travel data and of developing the initial major street and highway plan. The design year will be revised for periodic updates.

4. Services to be Provided by Local Community

The local community will furnish a study director or coordinator and will provide the following services:

A. Establishment, with jurisdiction at least throughout the study area, of a permanent, continuing, comprehensive transportation planning process - including the maintenance of current planning data (viz. that described in sections B-D) for annual reviews and revisions of the thoroughfare plan to maintain compatibility of the plan with the developing community.

B. Existing and design year planning data in the form requested by the Highway Department and, as far as practicable, in accordance with the schedule developed by the Highway Department. These data will include the number of dwelling units, population, employment, school enrollment, motor vehicle ownership and relative levels of retail sales for each of the designated traffic zones within the study area.

C. Analysis of subdivision regulations, setback requirements, land use controls, building codes & permit requirements, etc. and recommendations for any revisions or additional regulations needed to help the planning process achieve its purpose.

D. Analysis and forecast of the availability of local (city, county, etc.) governmental financial resources for transportation improvements in the study area through the design year.

E. Guidance to help the recommended transportation plan benefit social and community - value factors.

F. Background materials including right-of-way widths, city directories, topographic mapping, aerial photography and a base map of the study area.

G. A continuing and vigorous effort to preserve the integrity of the thoroughfare plan and to protect rights-of-way for all segments of the plan.

H. Contacts with the various military installations, local governing bodies and the general public to inform them as to the goals and objectives of the transportation study and to gain their support for the thoroughfare plan. Information to the news media will be reviewed with the Highway Department before being released to the general public

I. Suitable office space (including parking) for Highway Department staff and temporary help assigned to the study, including furniture, plumbing, telephones, post office box and janitor service.

5. Services to be Provided by the Highway Department

The Highway Department will provide the following services:

A. Cooperation with the community in the comprehensive transportation planning process.

B. Collection of origin-destination data on trips made to, from, through and within the study area by autos, trucks and taxis.

C. Inventory of arterial and collector streets and highways including pavement widths and setback distances.

D. Inventory of existing traffic control devices.

E. Traffic count coverage of existing major streets and highways including turning movement counts at key intersections.

F. Projection of travel patterns to design year by using population, land use and economic data furnished by the local community and travel characteristics developed from the origin-destination studies.

G. Development, in cooperation with the local community, of a thoroughfare plan showing recommended major streets and highways for the study area, based on travel patterns projected to design year.

H. Analysis and forecast (incorporating 4-D) of availability of financial resources for transportation improvements in the study are through the design year.

I. Cost estimates and implementation priorities for the recommended thoroughfare plan.

J. Report incorporating findings, analyses and recommendations of the comprehensive transportation study.

K. Outline of procedures for continuing phase of the study.

6. General Provisions

A. Each party to this agreement will bear the cost of the services for which it is responsible.

B. Either party may engage a consultant to furnish all or part of the services for which it is responsible. If a party engages a consultant, said party shall retain final responsibility for the services so furnished and the consultant shall receive from the other party the assistance and cooperation, in furnishing such services, to which his client would be entitled.

C. All material concerning the study will be reviewed and approved by both parties before final publication.

SOUTH CAROLINA
STATE HIGHWAY DEPARTMENT

By: _____
State Highway Engineer

Approved By: _____
Chief Highway Commissioner

ATTEST:

_____
Secretary-Treasurer

BEAUFORT COUNTY

LEGISLATIVE DELEGATION:

_____
James M. Waddell, Jr.
Senator

_____
W. Brantley Harvey, Jr.
Representative

_____
J. Wilton Graves
Representative

COUNTY BOARD OF DIRECTORS:

_____
Colden R. Battey, Jr.
Chairman

R E S O L U T I O N

WHEREAS, the Town of Port Royal, South Carolina, desires to cooperate in a continuing, comprehensive transportation planning process for the urban area including and surrounding the Cities of Beaufort and Port Royal; and

WHEREAS, Beaufort County appears to be the logical local unit of government to represent the said urban area and furnish the services required of the local community in connection with the comprehensive transportation planning process, as outlined in the attached Memorandum of Agreement for said planning process.

NOW THEREFORE, BE IT RESOLVED, by the Town Council at a regular meeting held on June 13, 1969, that Beaufort County is by this action requested and authorized to act for and on behalf of the Town of Port Royal in all matters pertaining to or related to initiating and conducting the continuing comprehensive transportation planning process, in cooperation with the State Highway Department, for the Beaufort urban area.

BE IT FURTHER RESOLVED, that the Town of Port Royal intends to cooperate completely with Beaufort County to ensure that said planning process will be effectively established and conducted and that the plan developed therefrom will be adopted and sucessfully implemented.

ATTEST:

Mary Y. Brum

Mary Y. Brum, Clerk

Mayor L B Graham

Warden Vernon H. Le Load

Warden John J. Hasta

Warden Jack T. Whitaker

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RESOLUTION

WHEREAS, the City of Beaufort, South Carolina, desires to cooperate in a continuing, comprehensive transportation planning process for the urban area including and surrounding the Cities of Beaufort and Port Royal; and

WHEREAS, Beaufort County appears to be the logical local unit of government to represent the said urban area and furnish the services required of the local community in connection with the comprehensive transportation planning process, as outlined in the attached Memorandum of Agreement for said planning process,

NOW THEREFORE, BE IT RESOLVED, by the City Council at a regular meeting held on June 24, 1969 that Beaufort County is by this action requested and authorized to act for and on behalf of the City of Beaufort in all matters pertaining to or related to initiating and conducting the continuing comprehensive transportation planning process, in cooperation with the State Highway Department, for the Beaufort urban area,

BE IT FURTHER RESOLVED, that the City of Beaufort intends to cooperate completely with Beaufort County to ensure that said planning process will be effectively established and conducted and that the plan developed therefrom will be adopted and successfully implemented.

I certify that the above Resolution is a true and correct copy of that appearing in the minutes of the City Council meeting held on June 24, 1969.

James S. Kirkland

James S. Kirkland, Clerk-Treasurer
City of Beaufort, S. C.

A-3

BEAUFORT AREA TRANSPORTATION STUDY
DWELLING UNIT SUMMARY REPORT

Survey No. _____ Card No. 3061
Sector No. _____ Sample No. _____
Zone No. _____

Interview Address _____
Name _____ Telephone No. _____

1. Type Dwelling Unit _____
2. How many people live in this dwelling unit? _____ Race _____ Military yes____ no ____
3. How many are employed? _____

Name & address of employment
1. _____
2. _____
3. _____
4. _____

4. Total number of licensed drivers _____ Licensed Drivers Making Trips _____
5. How many vehicles are owned or normally kept at this dwelling unit for personal use? _____
6. How many persons attend school? _____

Name & address of school
1. _____
2. _____
3. _____
4. _____

No. attending these schools _____ _____ _____ _____

Was interview made by telephone _____ Personal Contact _____ Combination Contact _____

ADMINISTRATIVE RECORD

Incomplete Interview Reason (circle)

1. Dwelling unit vacant.
2. Dwelling unit demolished.
3. Dwelling unit used for commercial purpose only.
4. Serious or contagious sickness in household.
5. Unable to contact after repeated attempts.
6. Residents refused to answer questions.
7. Other (specify) _____

Report returned to office _____
Date

I certify that all information recorded for this dwelling unit sample is correct and true.

_____
Interviewer's Signature

Supervisor's Comment: _____

A-3

BEAUFORT AREA TRANSPORTATION STUDY

INTERNAL TRIP REPORT

Page _____ of _____

Survey No. 3 0 6 | Card No. 2 | Sector No. ☐ | Sample No. ☐☐☐☐ | Zone No. ☐☐☐☐ | ☒☒☒ | ☒ Day of Travel | ☐ Month of Travel ☐☐

Person I.D.	Trip No.		Origin	Destination	Mode of Travel	Hour of Trip	Information Obtained By
			Address:	Address:	1. Auto Dr. 2. Pickup 3. Other Trucks		1. Telephone 2. Personal Contact
☒☒	☐☐	☒☒	Purpose: ☐☐☐☐☐☐☐ ☒☒ ☐	Purpose: ☐☐☐☐☐☐☐ ☒☒ ☐	☐	☐☐ ☒ ☒☒☒	☐ ☒☒
			Address:	Address:	1. Auto Dr. 2. Pickup 3. Other Trucks		1. Telephone 2. Personal Contact
☒☒	☐☐	☒☒	Purpose: ☐☐☐☐☐☐☐ ☒☒ ☐	Purpose: ☐☐☐☐☐☐☐ ☒☒ ☐	☐	☐☐ ☒ ☒☒☒	☐ ☒☒
			Address:	Address:	1. Auto Dr. 2. Pickup 3. Other Trucks		1. Telephone 2. Personal Contact
☒☒	☐☐	☒☒	Purpose: ☐☐☐☐☐☐☐ ☒☒ ☐	Purpose: ☐☐☐☐☐☐☐ ☒☒ ☐	☐	☐☐ ☒ ☒☒☒	☐ ☒☒
			Address:	Address:	1. Auto Dr. 2. Pickup 3. Other Trucks		1. Telephone 2. Personal Contact
☒☒	☐☐	☒☒	Purpose: ☐☐☐☐☐☐☐ ☒☒ ☐	Purpose: ☐☐☐☐☐☐☐ ☒☒ ☐	☐	☐☐ ☒ ☒☒☒	☐ ☒☒

_____
Interviewer's Signature

The Senate
State of South Carolina

JAMES M. WADDELL, JR.
SENATOR, BEAUFORT, COLLETON, HAMPTON AND JASPER COUNTIES
SENATORIAL DISTRICT NO. 13
SENATE OFFICE NO. 2

HOME ADDRESS:
BOX 547
BEAUFORT, S. C. 29902

Columbia

COMMITTEES:
AGRICULTURE
AVIATION
CHAIRMAN
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EDUCATION
FINANCE
FISH, GAME AND FORESTRY
HIGHWAYS
LOCAL LEGISLATION
1st VICE-CHAIRMAN
PENITENTIARY
1st VICE-CHAIRMAN
RULES

Dear Fellow Citizens:

As you may have read or heard, Beaufort County and the South Carolina State Highway Department are conducting a comprehensive transportation study in the Greater Beaufort area. The purpose of this study is to collect and analyze basic transportation facts and develop a sound, long-range highway and major street plan to serve the ever increasing transportation needs of the Beaufort metropolitan area.

For the plan to be successful, we must know where, when, how and why the people in the Beaufort area travel. The most reliable method thus far developed to obtain this travel data is by interviewing members of representative households in the area.

Your address has been selected by chance, and within the next several days an authorized interviewer will visit or telephone you to record trips made by all members of your household as drivers on the day preceding the interview and to obtain other information essential to the study.

Please bear in mind that the questions you will be asked, while some may appear personal, are necessary to obtain the facts needed to plan a system of streets and highways to make it easier for all of us to move about. Of course, answering is voluntary on your part, but this is your chance to do something about our traffic problems - so, try to give accurate and complete answers. The information you give will be kept strictly confidential.

Your cooperation will be greatly appreciated and will help develop a transportation plan tailored to the area's needs. If you have any questions, please contact Mr. Donald L. Gorsline at the Beaufort Area Transportation Study Office located in the Arsenal Building, Telephone Number 524-8239.

Yours very truly,

J. M. Waddell, Jr.
Senator

J. Wilton Graver
Member, House of Representatives

W. Brantley Harvey, Jr.
Member, House of Representatives

BEAUFORT AREA TRANSPORTATION STUDY
EXTERNAL CORDON REPORT

Survey No.- 3 0 6 | Card No. 3 | Station No. ☐☐☐ | Direction ☐ | Month ☐☐ | Day ☐ | Hour Beginning ☐☐

Serial No.	Veh. Type	No. In Veh.	Origin Where did you begin this trip?	Destination Where will you end this trip?	Home Address Where does car driver live or is truck based?	Outbound Stops in Survey Area		Entry/Exit Route
(office use) ☐☐☐	☐	☐	Address: Purpose: ☐☐☐☐☐☐☐ ☐	Address: Purpose: ☐☐☐☐☐☐☐ ☐	☐☐☐☐☐☐☐	☐☐	☐	☐☐☐
(office use) ☐☐☐	☐	☐	Address: Purpose: ☐☐☐☐☐☐☐ ☐	Address: Purpose: ☐☐☐☐☐☐☐ ☐	☐☐☐☐☐☐☐	☐☐	☐	☐☐☐
(office use) ☐☐☐	☐	☐	Address: Purpose: ☐☐☐☐☐☐☐ ☐	Address: Purpose: ☐☐☐☐☐☐☐ ☐	☐☐☐☐☐☐☐	☐☐	☐	☐☐☐
(office use) ☐☐☐	☐	☐	Address: Purpose: ☐☐☐☐☐☐☐ ☐	Address: Purpose: ☐☐☐☐☐☐☐ ☐	☐☐☐☐☐☐☐	☐☐	☐	☐☐☐

Vehicle Type

Passenger Cars
1. All

Trucks
3. Light (2 axle, 4 tire)
4. Medium (2 axle, 6 tire)
5. Heavy (3 axle or combination)

Interviewers Name _____

Field Check by _____

Coded _____

Approved _____

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BEAUFORT AREA TRANSPORTATION STUDY

SPECIAL INTERNAL TRIP REPORT

HOME ADDRESS OF DRIVER _____

VEHICLE TYPE 1-AUTO 2-PICKUP 3-OTHER TRUCK (CIRCLE ONE)

INTERVIEW HOUR	

SURVEY NO. 306 CARD NO. 2 3 SECTOR NO. ____ ZONE NO. 0550 ____ DAY OF TRAVEL ____ MONTH OF TRAVEL ____

	Trip No.		Origin	Destination		Time of Trip	
			Address	Address			
			Purpose	Purpose			
			Address	Address			
			Purpose	Purpose			
			Address	Address			
			Purpose	Purpose			
			Address	Address			
			Purpose	Purpose			
			Address	Address			
			Purpose	Purpose			

INTERVIEWER'S SIGNATURE

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HEADQUARTERS
Marine Corps Recruit Depot
Parris Island, South Carolina 29905

From: Commanding General
To: Selected Addressees

Subj: Greater Beaufort Area Transportation Study

1. Beaufort County and the South Carolina State Highway Department are conducting a comprehensive transportation study in the Greater Beaufort area. The purpose of this study is to collect and analyze basic transportation facts and develop a sound, long-range highway and major street plan to serve the ever increasing transportation needs of the Beaufort metropolitan area.

2. For the plan to be successful, they must know where, when, how, and why you travel. The most reliable method thus far developed to obtain this travel data is by interviewing members of representative dwelling units in the area.

3. Your name and address have been selected by chance, and within the next several days an authorized interviewer will visit or telephone you to record trips made by all drivers at your address on the day preceding the interview and to obtain other information essential to the study.

4. Please bear in mind that the questions you will be asked, while personal, are necessary to obtain the facts needed to plan a system of streets and highways to make it easier for all of us to move about. This is your chance to do something about our traffic problems. The information you give will be kept strictly confidential.

5. Your cooperation is appreciated; it will help develop a transportation plan tailored to the area's needs. If you have any questions, please contact Mr. Donald L. Gorsline, Beaufort Area Transportation Study Office, Arsenal Building, Beaufort, South Carolina. Tel: 524-8239.

W. H. MULVEY
Chief of Staff

HEADQUARTERS
Marine Corps Air Station
Beaufort, South Carolina 29902

PI:DIC:grl
11240
11 August 1969

From: Commanding Officer
To: Selected Addressees

Subj: Greater Beaufort Area Transportation Study

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KENNETH M. SCOTT
By direction

COMPARISON OF TRIPS CROSSING BEAUFORT RIVER SCREENLINE (#I)

Hour Beginning	Reported Trips	Ground Count	Percent Reported vs. Ground Count
6 A.M.	186	170	109.4
7	344	396	86.9
8	306	336	91.1
9	282	400	70.5
10	290	360	80.6
11	348	428	81.3
12 Noon	392	448	87.5
1 P.M.	346	393	88.0
2	387	425	91.1
3	439	384	114.3
4	551	568	97.0
5	447	602	74.3
6	417	547	76.2
7	370	400	92.5
Total 14 Hrs.	5105	5857	87.2
Total 24 Hrs.	6236	6500	95.9

COMPARISON OF TRIPS CROSSING BATTERY CREEK SCREENLINE (#II)

Hour Beginning	Reported Trips	Ground Count	Adjusted for Multiple Crossings	Percent Reported as Adjusted
6 A.M.	744	751	741	100.4
7	1458	1652	1608	90.7
8	968	1261	1186	81.6
9	911	1158	1116	81.6
10	1090	1229	1175	92.8
11	1382	1642	1574	87.8
12 Noon	1337	1853	1782	75.0
1 P.M.	1167	1635	1548	75.4
2	1229	1523	1447	84.9
3	1313	1768	1683	78.0
4	2035	2631	2546	79.9
5	1715	2103	2030	84.5
6	1127	1637	1557	72.4
7	1057	1549	1452	72.8
Total 14 Hrs.	17533	22392	21445	81.8
Total 24 Hrs.	20693	27000	25858	80.0

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COMPARISON OF TRIPS CROSSING CORDON

INTERNAL BASED VEHICLES

Hour Period	External Survey	Internal Survey	Int./Ext. Percent
6-7 A.M.	74	88	118.9
7-8	179	165	92.2
8-9	181	216	119.3
9-10	183	172	94.0
10-11	189	206	109.0
11-12	200	199	99.5
12-1 P.M.	198	229	115.7
1-2	221	227	102.7
2-3	228	171	75.0
3-4	240	287	119.6
4-5	271	324	119.6
5-6	318	384	120.8
6-7	226	187	82.7
7-8	196	216	110.2
Total 14 Hrs.	2904	3071	105.8

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COMPARISON OF TRIPS CROSSING BEAUFORT RIVER SCREENLINE (#I)

FACTORED

Time Period	Expanded Vehicle Trip Data			Ground Count	Percent
	Internal	External	Total		
6-7 A.M.	99	100	199	170	117.1
7-8	173	192	365	396	92.2
8-9	186	152	338	336	100.6
9-10	136	176	312	400	78.0
10-11	151	178	329	360	91.4
11-12	176	217	393	428	91.8
12-1 P.M.	220	209	429	448	95.8
1-2	207	184	391	393	99.5
2-3	202	233	435	425	102.4
3-4	282	225	507	384	132.0
4-5	330	285	615	568	108.3
5-6	279	230	509	602	84.6
6-7	276	197	473	547	86.5
7-8	258	171	429	400	107.3
Total 14 Hrs.	2975	2749	5724	5857	97.7
Total 24 Hrs.	3545	3445	6990	6500	107.5

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COMPARISON OF TRIPS CROSSING BATTERY CREEK SCREENLINE (#II)

FACTORED

Time Period	Expanded Vehicle Trip Data			Adjusted Ground Count	Percent
	Internal	External	Total		
6-7 A.M.	635	142	777	741	104.9
7-8	1336	248	1584	1608	98.5
8-9	1000	192	1192	1186	100.5
9-10	921	234	1155	1116	103.5
10-11	1198	218	1416	1175	120.5
11-12	1500	255	1755	1574	111.5
12-1 P.M.	1442	225	1667	1782	93.5
1-2	1215	235	1450	1548	93.7
2-3	1370	215	1585	1447	109.5
3-4	1374	275	1649	1683	98.0
4-5	2089	325	2414	2546	94.8
5-6	1839	292	2131	2030	105.0
6-7	1144	239	1383	1557	88.8
7-8	1180	162	1342	1452	92.4
Total 14 Hrs.	18243	3257	21500	21445	100.3
Total 24 Hrs.	21230	4093	25323	25858	97.9